JUL 21 1927

The Engineer.

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VOL. CXLIV.—No. 3730] LONDON: FRIDAY EVENING, JULY 8, 1927 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—
1. 1800 Tons STEEL RAILS B.S. 60/R F.F. Section.
2. About 205 Tons DOGSPIKES.
3. About 140 Tons STEEL FISHBOLTS and NUTS.
4. 450 K.W. STEAM TURBINE.

Tenders due on the 15th July, 1927, for No 1, on the 19th July, 1927, for Nos. 2 and 3, and on the 5th August, 1927, for No. 4.
Specifications and forms of Tender obtainable from the above at a fee of 5s. per set, which will not be returned. 5948

The Admiralty have available for DISPOSAL the DREDGER "ST. PATRICK," lying at Rosyth.
Type, twin screw, bow well barge-loading bucket ladder dredger.
Length between perpendiculars, 174ft.
Length overall, 181ft.
Beam, 33ft.
Moulded depth, 12ft.
Draught light (mean), 8ft. 1in.
Draught loaded (mean), 9ft. 1in.
Gross tonnage, 461.54.
Two sets compound surface condensing engines.
Dredging equipment :
Capacity of baskets, 20 cu. ft.
No. on string, 42.
Depth to which vessel will dredge, 48ft.
Built and engined by Messrs. Lobnitz and Co., Ltd., Renfrew.
The vessel is for sale as and where she lies without any guarantee.
Further particulars, Tender forms, conditions of sale, &c., may be obtained upon application to the DIRECTOR OF NAVY CONTRACTS, Admiralty, Room 62, Princes House, Kingsway, London, W.C. 2.
Sealed Tenders are due at the Admiralty by Noon on Thursday, the 11th August, 1927. 5853

Assistant Civil Engineers REQUIRED in the Works and Buildings Directorate, Air Ministry. Candidates must be between the ages of 25 and 30 years on the 21st July, 1927; those who have served or are serving in the Army, Navy or Air Force may deduct from their actual age any time, not exceeding five years, during which they have so served. A candidate must be either—
(i) A Corporate Member of the Institution of Civil Engineers; or
(ii) A Corporate Member of the Royal Institute of British Architects; or
(iii) A Corporate Member of the Institution of Municipal and County Engineers; or
(iv) A person qualified to become a Corporate Member of the Institution of Civil Engineers on attaining the prescribed age; or
(v) A holder of a Degree in Engineering or an equivalent diploma; or
(vi) A person who has held a Commission in the Royal Engineers or an appointment in Civil Engineering under the British or Indian Government or a Dominion or Colonial Government, and has been precluded by such employment from obtaining any of the above qualifications.

He must also have served for two years in an engineering firm of good standing or on the engineering staff of a Government or large municipal department or in the Royal Engineers, and have there gained experience in Civil Engineering, both in the Drawing-office and on important Engineering Works. Special consideration will be given to candidates who served in H.M. Forces during the war.
Successful candidates will serve on probation for two years, and will not be confirmed unless and until they have passed such probation to the satisfaction of the Air Ministry.
Commencing salary, £250 per annum, plus Civil Service Bonus which at the current rate amounts to £127 per annum.
No candidate will be appointed who fails to pass a strict medical examination as to his physical fitness for service at home and abroad.
Copies of regulations and forms of application can be obtained from the SECRETARY, Air Ministry, Adastral House, Kingsway, London, W.C. 2. The latter should be returned completed so as to reach that office not later than the 21st July, 1927.
Candidates must bear any expenses which they may incur in attending for interview. 5868

Assistant Engineers (20) REQUIRED for the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment, he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 26, preferably unmarried, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers and possess a Civil Engineering Degree or obtained such other diploma or distinction in engineering as the Secretary of State may decide in any particular case or have completed articles with a Civil Engineer of good standing and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition, candidates must have had at least one year's practical experience of civil engineering under a qualified civil engineer.—Apply at once by letter, giving brief details of qualifications and experience and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting clearly at the head of application M/15224. 5818

Wanted at Once, Temporary DRAUGHTSMEN, quick, accurate, with general knowledge of Civil Engineering and Building Construction. Preference given to ex-Service men.—Apply, giving full particulars of experience, age, salary required, when disengaged, and enclosing copies of recent testimonials, to CIVIL ENGINEER-IN-CHIEF, Admiralty, S.W. 1. 5947

The Engineer

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PUBLIC NOTICES

Northampton Polytechnic INSTITUTE, ST. JOHN-STREET, LONDON, E.C. 1.
SCHOLARSHIPS IN ENGINEERING AND OPTICS.

An EXAMINATION will be held on JULY 20th and 21st at the Polytechnic for the award of the following Scholarships :—

THREE SCHOLARSHIPS IN ENGINEERING, VALUE £18 PER ANNUM.

These Scholarships are tenable at courses extending over four years in Civil, Mechanical, Electrical, Aeronautical, or Radio Engineering, and including ten months' practical experience in the works of large industrial firms.

ONE SCHOLARSHIP IN OPHTHALMIC OPTICS, VALUE £18 PER ANNUM.

For further information apply to S. C. LAWS, M.A., M.Sc., Principal. 5919

University of Liverpool.
FACULTY OF ENGINEERING.

DEAN: Professor C. O. BANNISTER, M. Eng., Assoc. R.S.M., F.I.C., M. Inst. M.M.

The University awards the Degrees of B. Eng., M. Eng., D. Eng., Ph.D., and a Certificate and Diploma in Engineering.

Degree Candidates must pass an approved Matriculation Examination. Certificate Candidates must submit evidence of having received a good general education. Diploma Candidates must possess the Certificate in Engineering.

The Courses are designed for students desiring to qualify as MECHANICAL, ELECTRICAL, CIVIL or MARINE ENGINEERS, as NAVAL ARCHITECTS and METALLURGISTS or METALLURGICAL ENGINEERS. The Courses cover the subject of examination for Associate Membership of the Institutions of Civil, Mechanical, and Electrical Engineers. The Institutions named, subject to certain conditions, accept the Degree of B. Eng. in lieu of part, and in some cases the whole, of the examinations for Associate Membership. The various Departments are housed in commodious and well-equipped buildings, and provide ample facilities for research.

A prospectus of the Faculty, giving particulars of Courses and a large number of Entrance and Post-graduate Scholarships, may be had on application to the undersigned.

EDWARD CAREY, Registrar. 5808

PUBLIC NOTICES

The University of Liverpool.
FACULTY OF ENGINEERING.

The FACULTY of ENGINEERING invites APPLICATIONS from Graduates of the Liverpool University in Engineering for TWO MUNITIONS COMMITTEE RESEARCH FELLOWSHIPS, tenable for two years in the Departments of Mechanical, Electrical, Civil or Marine Engineering or in Naval Architecture or Metallurgy. The value of the Fellowships is £250 for the first year and £350 for the second year.

Applications, with an outline of the research contemplated, should be forwarded to the DEAN OF THE FACULTY before July 23rd. 5943

The University of Sheffield.
SESSION 1927-28.
Vice-Chancellor: SIR HENRY HADOW, C.B.E., D.Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

The LECTURE COURSES commence OCTOBER 5th, 1927.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 27th, 1927.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to W. M. GIBBONS, Registrar. 5917

PUBLIC NOTICES

The Royal Technical College, GLASGOW.
DEPARTMENTS OF ENGINEERING.

Mechanics and Mechanical Engineering :
Professor, ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.
Associate Professor, WILLIAM KERR, Ph.D., A.R.T.C.
Electrical Engineering :
Professor, STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
Civil Engineering :
Professor, GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
Mining Engineering :
Professor, DANIEL BURNS, M. Inst. M.E.
Chemical Engineering :
Professor of Technical Chemistry, THOMAS GRAY, D.Sc., LL.D., Ph.D., F.I.C.

Complete courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.
Composition fee, 25 guineas per annum.
SESSION 1927-8 BEGINS on TUESDAY, SEPTEMBER 20th.
Calendar, by post, 3s., and prospectus, gratis, may be obtained on application to the DIRECTOR. 5911

Bengal-Nagpur Railway Company, LIMITED.
The Directors are prepared to receive TENDERS for—
(1) WELDLESS STEEL BOILER TUBES.
(2) STEEL TYRES.
(3) ONE 10-Ton STEAM TRAVELLING CRANE.

Specifications and forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 4th July, 1927.
A fee of 10s. will be charged for each specification, which is NOT returnable.
Tenders must be submitted not later than NOON on the following dates :—
For No. (1) on 12th July, 1927.
" (2) " 14th "
" (3) " 18th "
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the orders.
BY ORDER OF THE BOARD,
E. C. VOLKERS, Secretary.
4th July, 1927. 5896

Bengal-Nagpur Railway Company, LIMITED.
The Directors are prepared to receive TENDERS for—
73 COPPER FIRE-BOX PLATES.
Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 1st July, 1927.
A fee of 10s. will be charged for the specification, which is NOT returnable.
Tenders must be submitted not later than NOON on Tuesday, 12th July, 1927.
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves th right of reducing or dividing the order.
BY ORDER OF THE BOARD,
E. C. VOLKERS, Secretary.
1st July, 1927. 5912

Bengal-Nagpur Railway Company, LIMITED.
The Directors are prepared to receive TENDERS for—
(1) BOILERS for "G" and "G S" Class BOGIE MAIL ENGINES, 5ft. 6in. gauge.
(2) FIVE BOGIE TENDERS, 5ft. 6in. gauge.
Specifications and forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 6th July, 1927.
A fee of 20s. will be charged for each specification, which is NOT returnable.
Tenders must be submitted not later than NOON on the following dates :—
For No. (1) on 20th July, 1927.
" (2) " 21st "
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the orders.
BY ORDER OF THE BOARD,
E. C. VOLKERS, Secretary.
6th July, 1927. 5918

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PUBLIC NOTICES

Borough of Acton.

ELECTRICAL PLANT.

The Town Council of Acton invites TENDERS for the SUPPLY, DELIVERY and ERECTION of a VERTICAL TWO-CRANK NON-COMPOUND ENGINE, 50 K.W. GENERATOR, and other Plant at the Council's Destructor Works.

Specification and form of Tender may be obtained from the Borough Engineer, Municipal Offices, Acton, W. 3, to whom Tenders must be delivered in sealed envelopes endorsed "Electrical Plant," on or before 4 p.m., 16th July, 1927.

The Corporation does not bind itself to accept the lowest or any Tender, and canvassing members of the Council, either directly or indirectly, will disqualify.

J. MORGAN,
Town Clerk.

Municipal Offices,
Acton, W. 3.
2nd July, 1927. 5895

Borough of Acton.

NEW FLUE AT DESTRUCTOR, WALES FARM-ROAD, W. 3.

The Town Council of Acton invite TENDERS for the ERECTION of a NEW OVERHEAD FLUE. Bills of quantities and form of Tender may be obtained and the general conditions seen at the office of the Borough Engineer between 10 a.m. and 4 p.m. daily, except Saturdays, when the hours are 10 a.m. till 12 noon.

A deposit cheque of £1 1s., made payable to the Borough Treasurer, should be sent with each application, which will be refunded on receipt of a bona fide Tender and the return of all papers.

Tenders to be delivered in the endorsed envelopes supplied on or before 4 p.m., Tuesday, July 19th, 1927.

The Council does not bind itself to accept the lowest or any Tender, and canvassing members of the Council, either directly or indirectly, will disqualify.

J. MORGAN,
Town Clerk.

Municipal Offices,
Acton, W. 3.
6th July, 1927. 5942

Clyde Navigation Trust.

TO SHIPBUILDERS.
GRAB HOPPER DREDGER.

The Trustees of the Clyde Navigation invite TENDERS for a GRAB HOPPER DREDGER, 125ft. long overall, 26ft. breadth moulded, and 10½ft. depth moulded.

The specification and form of Tender, along with drawings, may be obtained on application at this office to Mr. Daniel Fife, Mechanical Engineer, on payment of a fee of £2 2s., which will not be returned.

Sealed Tenders, marked "Tender for Grab Hopper Dredger," require to be lodged with the undersigned not later than Noon on Monday, 8th August.

The Trustees may not accept the lowest or any Tender.

JAS. MACFARLANE,
General Manager.

16, Robertson-street, Glasgow
6th July, 1927. 5926

Royal State Railways of Siam.

NOTICE.

SEALED TENDERS for the SUPPLY of SUPERSTRUCTURES for STEEL RAILWAY BRIDGES will be received by the Administration of the Royal State Railways of Siam, Bangkok, up till 14.00 o'clock on the 15th October, 1927, at which place and hour the Tenders will be publicly opened and read.

Blank Tender forms, general conditions, specifications and drawings may be obtained from Messrs. Sandberg, 40, Grosvenor-gardens, London, S.W. 1, upon payment of £1 10s. per set, which sum will not be refunded.

Right is reserved to reject all or any of the Tenders, and to accept any Tender which is to the best interests of the Royal State Railways of Siam. 5892

South Indian Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STRUCTURAL STEELWORK (Foremen's Offices).
2. HORIZONTAL FORGING and HOT SAW and BURRING MACHINE.
3. HORIZONTAL BENDING and FORMING MACHINE.
4. INDIA RUBBER HOSE, SHEETS, &c.
5. SPARE PARTS for TRAIN LIGHTING CELLS (i).
6. MISCELLANEOUS ARTICLES AND MATERIALS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked, "Tender for Structural Steelwork," or as the case may be, must be left with the undersigned not later than 12 Noon on Friday, the 29th July, 1927, in respect of Specification No. 1, and the 22nd July, 1927, in respect of Specification Nos. 2 to 6.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of Specifications Nos. 1, 2, 3 and 4, and of 10s. for each copy of Specifications Nos. 5 and 6.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, S.W. 1.
6th July, 1927. 5949

The Assam-Bengal Railway

COMPANY, Limited, is prepared to receive TENDERS for—

TWO 6-WHEELED BOGIE WELL WAGONS.

Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged, which cannot, under any circumstances, be returned.

Drawings may be had, at the cost of the tenderer, by application to Messrs. Hodges Bennett and Co., Ltd., 78, Queen Victoria-street, E.C. 4.

Tenders must be delivered at the Company's Offices not later than Noon on Thursday, the 21st July, 1927.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,

THOS. C. BRETT,
Secretary.

4th July, 1927. 5897

The Madras and Southern Mahratta Railway Co., Ltd.

25, Buckingham Palace-road, S.W. 1, invite TENDERS for :—

SIX 60ft. CLEAR DECK SPANS (approximate total weight equals 143 tons).

Tenders are due in by 10.30 a.m. on Wednesday, 3rd August, 1927.

Tender forms obtainable at above address ; fee One Guinea each, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender. 5941

For continuation of Small Advertisements see page 3.

THE ENGINEERS' CLUB.
39, Coventry Street, W.1.
Annual Subscriptions:—Town Members £10 10 0
Country " 5 5 0
Overseas " 2 2 0
71 Bedrooms.
Application for membership should be sent to "The Secretary" at the above address.

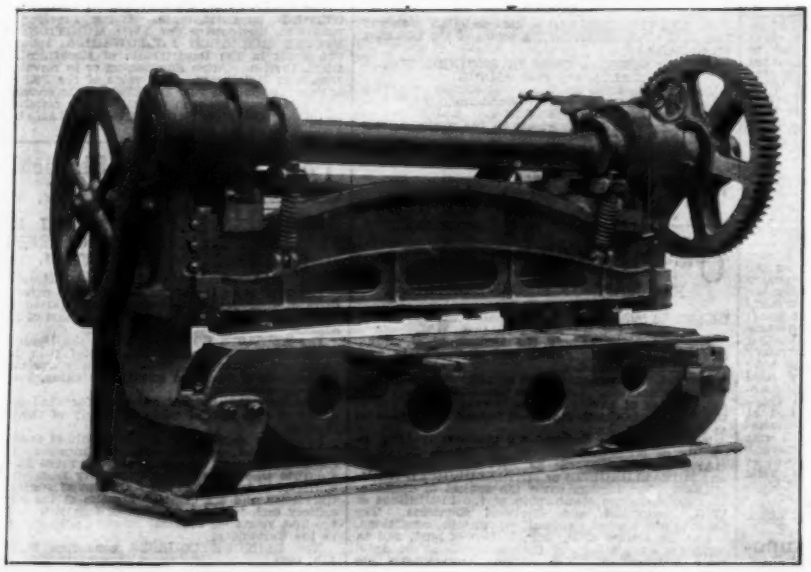
HIGGS (HM) MOTORS
WITTON BIRMINGHAM

When looking through the long lists of second-hand machines one seldom sees a HIGGS MOTOR offered ; the only conclusion one can come to is that owing to the sound construction and excellent performance there is always a ready market for them.

On the rare occasions that they are offered the price asked closely approaches to-day's new price.

This important fact should be borne in mind when purchasing.

MODERN GUILLOTINE SHEARING MACHINES



With Clutch Stop-Motion and Automatic Plate Holder.

Illustration shows 8′ 0″ × 7/16″ Machine.

Multiple Punching Machines.

With Automatic Spacing, Edge Shearing Attachment, Butt Shearing Attachment, and Patent Curved Line Motion for Shell Plates with Sheer.

Pneumatic Riveters.

More than 90 Patterns for all Purposes.

DE BERGUE & Co. LTD. MANCHESTER.

A Seven-Day Journal

Census of Engineering Production.

THE figures of the third Census of Production, published in last week's Board of Trade Journal, reveal one or two striking facts concerning the engineering industry of this country. They enable a comparison to be made of the activities in 1924 and in 1907 of the general engineering industry—excluding the motor and cycle trades and marine engineering—and the electrical engineering industry. In 1907 the general engineering industry registered an output valued at £88·191 million, and the electrical engineering industry one of £13·889 million. The corresponding figures for 1924 were £140·159 and £69·938. In 1907 electrical engineering production was therefore only about 14 per cent. of the total, whereas in 1924 it was about 33 per cent. Making allowances for the advance in prices, the figures indicate that the volume of production by the general engineering industry was very little if anything greater in 1924 than in 1907, whereas in electrical engineering they indicate a very considerable development. Of the total value of the engineering output in 1924, namely, £223·759 million, the cost of materials purchased and used was £101·748 and the value of the work given out was £4·949. The difference of £117·062 represents the net output of the engineering industry, and is equivalent to £199 per head of persons employed. In 1907 the per capita figure was £109. In 1924 the average number of persons employed in the engineering industry was 587,822, of whom 493,711 represented operative staffs and 94,111 management, technical and clerical staffs. In 1907 the aggregate figure was 454,973, divided in the proportion of 416,092 to 38,881 between the two sections. While therefore the operative section has increased relatively slightly the management, &c., section has increased nearly 2½ fold.

Railway Electrification in India.

AN important electric railway contract has been placed with the British Thomson-Houston by the High Commissioner for India. The contract covers the complete sub-station and track sectioning equipment for the electrification of the main lines of the Indian State railways from Bombay to Igatpuri, and from Bombay to Poona, which is being carried out to the designs of Merz and McLellan. At the sub-stations the three-phase 50-cycle current which will be supplied at a pressure of 95,000 volts, will be converted into direct-current at a pressure of 1500 volts by means of step-down transformers and rotary converters. There will be seven double unit sub-stations and four triple unit sub-stations, with a total capacity of 65,000 kilowatts. Each of the 2500-kilowatt converters will consist of two machines in series. The system of operation differs from the fully automatic equipment supplied by the British Thomson-Houston Company for the Natal electrification scheme of the South African railways in that approximately half the number of sub-stations will be semi-automatic, and from these sub-stations the remainder will be controlled by supervisory control apparatus. The track signalling cabins will be automatic, and by means of supervisory control apparatus will give indications at the attended sub-stations. The contract will provide a considerable amount of work at Rugby, where the rotary converters will be built, whilst the control gear, 95,000 volt switchgear and lighting arresters and 1500-volt switchgear will be constructed at the company's works at Willesden. The sub-contractors to the British Thomson-Houston Company for the transformers are the Brush Electrical Engineering Company, and for the supervisory control equipment Standard Telephones and Cables, Ltd.

Rhine Navigation.

IN the controversy concerning schemes for improving the navigation of the Rhine between Strasburg and Bâle the Swiss at one time appeared to favour the German proposal to create channels by anchoring to the bed of the river masses of stakes, withies and brushwood, which would divert the flow of water along the bed and cause it to scour out a sufficiently deep channel. This system has been adopted on the Loire and other rivers with satisfactory results. The French proposal to construct a canal parallel to the river between Kembs and Strasburg, with seven locks and the same number of hydro-electric generating stations, which would produce a total of something like 800,000 horse-power, was regarded by the Swiss as a costly undertaking that would require considerable time to complete. Two years ago the Central Commission of the Rhine sanctioned the carrying out of both schemes in the belief, apparently, that all three countries concerned would eventually collaborate in the execution of one of them. The French lost no time in getting on with the scheme for the construction of the Alsace Canal, which will allow 2000-ton barges to navigate between Bâle and Strasburg at all seasons of the year. The Bill for the construction of the first Kembs section with its hydro-electric plant has now passed the Chamber of Deputies, and it is hoped to get it through the Senate without further delay, so that the Kembs undertaking can be put in hand before Switzerland and Germany are able to make any notable progress with their schemes. So far their efforts have been directed more particularly to the installation of hydro-electric plants above Bâle and the works at Schwœrstadt have already been begun. It is affirmed in France that the enthusiasm of the Swiss for the scheme to canalise the Rhine below Bâle has abated because Germany offers as its contribution to the cost a sum of 70 million Swiss francs which were to have been devoted to improvements above Bâle. This rumour may be intended to hasten the construction of the Alsace Canal in the belief that, when the Swiss see that the French scheme is well in hand, they will be less inclined to spend money on the alternative scheme they propose to carry out with the assistance of Germany.

Railwaymen and the Trades Union Bill.

WE are glad to see that Mr. J. H. Thomas succeeded on Tuesday last in heading the National Union of Railwaymen off the ill-advised action which the President, Mr. W. Dobbie, had proposed, in opposition to the Trades Union Bill. The Union was unanimous in its condemnation of the Bill, as was to be expected, and the point at issue was whether or not it should "take up arms against the slings and arrows" of an outrageous Government or oppose the measure by constitutional means. In other words, whether the union should refuse to observe the terms of the Act, when it becomes the law of the land, whether, even, it should go to the extent of striking as a protest against it, or whether it should wait till the Labour party again came into power with sufficient strength to effect the repeal of the Act. Mr. Thomas, himself, trounced the Bill roundly at the general meeting, but at the private delegates' session which followed he managed, after a strenuous fight with the extremists, to carry his point that the opposition should be conducted on strictly constitutional lines. When the question was put to the vote 70 delegates were on his side as against only 10 in favour of the policy suggested by Mr. Dobbie in his presidential address on Monday last.

Deterioration of Structures in Sea Water.

THE Committee on Deterioration of Structures Exposed to Sea Action was set up in 1916 by the Institution of Civil Engineers under the auspices of the Department of Scientific and Industrial Research. Its duty was to study the deterioration of structures in timber, metal, and concrete when exposed to the action of sea water and to ascertain how such deterioration could be minimised. At the outset all the funds required were supplied by the Department, but from March 31st, 1924, onwards for a period of five years the Department could undertake to contribute an amount not exceeding half the expenditure. An appeal for assistance was therefore made to certain harbour authorities and similar bodies, and a satisfactory response was secured. This year is the last covered by the outside subscriptions and the assistance from the Department, and after March 31st, 1928, the Committee will be entirely dependent upon outside support. An appeal is now being made by the Committee to previous supporters to renew their subscriptions for a further period of five years and to others who have not so far subscribed to do so now. Up to March 31st this year the Committee received £10,393 from the Department and £3154 from outside sources. To enable it to complete its work it is appealing for subscriptions during the next five years sufficient to provide £1100 a year. It is emphasised that no new investigations will be entered upon and that the money is required for the purpose of bringing the Committee's work to a close, including the preparation of a report giving the general results of the experiments.

Retirement of Mr. A. W. Szlumper.

THE doyen of the chief engineers of British railways and the last of what may, with the courtesy due to them, be called the old school, has, in the person of Mr. A. W. Szlumper, the chief engineer of the Southern Railway, retired. Mr. Szlumper has been prominent in railway engineering circles since, some thirty-six or thirty-seven years ago, he was put in charge of the Nine Elms and Waterloo widening of the London and South-Western Railway. In 1914 he was suddenly called upon to become the chief engineer as a consequence of the tragic death, in the hunting field, of Mr. J. W. Jacomb-Hood. One result of that appointment was that Mr. Szlumper became responsible for the completion of Waterloo new terminus and for the civil engineering details of the first electrification scheme carried out by that company between 1913 and 1916. The formation of the Southern Railway, as from January 1st, 1923, when he was made its chief engineer, brought him great responsibilities, as the practice, in many respects, differed on the London, Brighton and South Coast and the South-Eastern and Chatham Railways from that found on the London and South-Western Railway. One of the earliest things to be done was to re-arrange the districts, which, incidentally, led to their number being reduced, and then came standardisation. The strengthening of the underbridges on the South-Eastern and Chatham was already in hand, and Mr. Szlumper continued that work, and it is now nearly completed and big engines can already run on practically any section of the main line of the three former companies. Another outstanding work in which Mr. Szlumper has shared has been the electrification of the eastern section and the further work there and on the central division.

New Ships for the Australian Navy.

THE submarines Oxley and Otway, built by Vickers Ltd., at Barrow, and launched respectively in June and September, 1926, are now practically completed. It is understood that they will shortly proceed to Australia, but the question as to whether they shall sail under escort or independently is still undecided. These vessels are almost identical with the Oberon and other "O" class submarines now building for the Royal Navy. The surface displacement is 1400 tons, but no other details have been released. That they have cost well over £600,000 is made evident by the fact that £596,600, exclusive of guns, has been expended on the Oberon. Good progress is being made on the cruiser Australia, which was launched at Clydebank on March 17th this year, and it is hoped to have her ready for trials by February next. Her sister ship, Canberra, launched from the same yard on May 31st by Princess Mary, is due to be completed in May, 1928. Both ships belong to the "County" class and were built to Admiralty specifications. The standard displacement is 10,000 tons, which does not include the 3400 tons of fuel oil that each vessel will carry at full load. The machinery is designed for 80,000 S.H.P. and a speed of 31½ knots, and the main armament comprises eight 8in. guns. A fifth post-war unit of the Royal Australian Navy is the aircraft carrier Albatross, which was begun at the Cockatoo Yard, Sydney, last year. Although this vessel has a standard displacement of only 6000 tons, it is believed that she will prove capable, not only of carrying a large number of aeroplanes, but of serving as a floating aerodrome in the sense that machines will be able both to fly off from and alight on her deck.

The Mersey Tunnel.

RAPID progress is being made with the preliminary borings for the new Mersey Tunnel. The work now being carried out by Edmund Nuttall, Sons and Co., is preparatory to that involved in the construction of the tunnel proper, and is designed to explore and prepare the ground through which the finished tunnel will pass. Some 700,000 cubic yards of excavation, it is estimated, will be made in connection with the preliminary borings, and the work is expected to be completed by April next, twenty-five months after the beginning of the operations. The completion of the new tunnel itself will, it is estimated, take five years. On the preparatory boring 350 men are engaged, and work is being carried on night and day. The finished tunnel will provide four lines for traffic on the upper roadway, and two main lines for traffic on the lower. The ventilation of the tunnel is to receive particular attention in view of the fact that much of the transport passing through it will be of the petrol-driven type.

International Press Conference.

THE representatives of the Press of nearly two dozen countries assembled for luncheon on Wednesday at Guildhall, at the invitation of the Lord Mayor and Corporation of the City of London. The occasion was provided by the meeting in London of the International Press Conference, the first function of its kind organised since the war. The Lord Mayor, in proposing the toast of "The World's Press," said that it was no hollow tribute to state that the international Press had the power to inform, to influence opinion, and to create the atmosphere which meant so much to the ordinary citizen. The Conference was really a great international peace conference, a veritable Locarno of journalism, intended to make the mighty instrument which the delegates controlled one for the good of the profession and the good of mankind. No League of Nations could hope to succeed without the members of the Press acting as *liaison* officers between the peoples represented by the delegates. Monsieur Lima, President of the International Association of Journalists, responding, warmly praised the British Press, which he described as the most powerful in the world. Mr. T. P. O'Connor remarked that the friendly reception that had been accorded to all the delegates, some of them representing nations that had lately been our enemies, showed that if there was not peace in the world in the future, it would not be from any want of good feeling on the part of the people of these islands. The British nation, he claimed, forgave past enemies more readily and more generously than any other. The Lord Mayor, responding, said that the permanent peace of the world depended largely on the efforts of the Press.

Main Line Railway Electrification.

By Sir PHILIP DAWSON, M. Inst. C.E., &c., Consulting Engineer, and

S. PARKER SMITH, D.Sc., M.I.E.E., Professor of Electrical Engineering, Royal Technical College, Glasgow.

No. XVII.—ITALY.*

1. Historical: Reasons for Electrification.

TRIALS of electrical haulage on lines carrying heavy traffic were first made in Italy in 1899–1901. In February, 1899, a reduced service was commenced on the Milan–Monza line, using accumulator traction, the experiments being continued in 1901 on the Bologna–San Felice section. It was hoped that this system would be capable of dealing with light local traffic, both passenger and goods, since the available capital outlay was limited. While the results were technically satisfactory, it was clear that a traffic increase would prove to be outside the capabilities of the method, so that it was finally abandoned.

In 1901 the electric working of the Milan–Varese line—60 kiloms.—was commenced with the third-rail direct-current system; while the Lecco–Colico–Sondrio and Colico–Chiavenna lines, known as the Valtellina Railway, were equipped for 15-cycle, three-phase, working over a distance of 106 kiloms. Difficulties due to short circuits were experienced with the Milan–Varese motor generator sub-stations, but they were overcome satisfactorily. The Valtellina line proved completely successful.

Italy's chief reason for railway electrification has been one of economics. Being poor in coal but rich, in certain districts, in water power, there was a definite economic advantage to be obtained by becoming independent of foreign coal supplies. Further, difficulties and dangers in long tunnels with steam working were becoming more and more serious, while many lines had reached the limit of their capacity with steam. After nine years the three-phase system, having proved successful on the Valtellina Railway, was extended to the heavily worked Ligurian and Piedmont lines, and later to the Giovi railways, connecting the port of Genoa with the great industrial centres of Milan and Turin, *viâ* the Appenine Mountains. The conversion of further lines in this district was also undertaken, with three-phase, 3000-volt, 15-period equipment. The lines electrified up to the end of 1922 are shown in Table I.

TABLE I.—*Electrification of the Italian State Railways.*
Work Completed by 1922 on the Three-phase System, 3000 Volts, 15 Cycles.

Year.	Line.	Route length, kiloms.
1901	Lecco–Colico–Sondrio and Colico–Chiavenna (Valtellina)	106
1910	Giovi lines	60
1911	Savona–Ceva	46
1913	Lecco–Monza (Valtellina)	37
1914	Bussoleno–Modane (Mont Cenis)	60
1916	Savona–Genoa (coast line)	43
1917	Turin–Pinerolo	37
1919	Bussoleno–Susa	8
1919	Bussoleno–Turin (Mont Cenis)	40
1921	Turin–Ronco	136
1922	Alessandria–Voghera	38
1922	Tortona–Novi	19
1922	Tortona–Ronco	35
	Total	665

A new electrification programme was drawn up in 1920, the war having intensified the imported fuel problem, and a proposal to electrify 4500 kiloms. of route on the State Railways was formulated. The additional lines already completed and in operation, or shortly to be opened, are shown in Table II.:—

TABLE II.—*Italian State Railways.*
Work Begun in 1921 and now Completed or under Construction.

Line.	Route length, kiloms.
Genoa–Spezia–Pisa–Leghorn	183
Alessandria–Sampierdarena	70
Ventimiglia–Cuneo	73
Pinerolo–Torre Pelice and Bricherasio–Barge	20
Bologna–Pistoia–Florence	134
Rome–Tivoli–Sulmona*	174
Rome–Carano–Nettuno*	59
Benevento–Foggia†	101
Total	814

* High-voltage normal frequency, three-phase system.
† High-voltage, direct-current system.

The full electrification programme, however, is a far-reaching one, and embraces those lines shown in Figs. 1 and 2 and tabulated below in Table III.

2. Choice of System.

The electrification of the Italian railways dates back to the beginning of this century, which largely explains the adoption of the three-phase system at the outset. At that time the direct-current system at high voltage was undeveloped, and no single-phase motor was equal to the task of providing a traction service. The three-phase induction motor, however, was already well known, and its robust construction realised. The Italian engineers succeeded in making it suitable for traction.

The disadvantages of the three-phase system are chiefly the necessity for a double contact line—the track providing the third phase—which becomes complicated at crossings, and the limitation of speed

TABLE III.—*Lines to be Electrified in the Future.*

Line.	Route length, kiloms.
Bergamo–Calolzio	26
Usmate–Ponte S. Pietro	18
Florence–Faenza–Bologna	149
Milan–Bologna	215
Parma–Vezzano	111
Fornovo–Borgo S. Donnino	24
S. Stefano–Sarzana	7
Bologna–Verona	116
Verona–Brenner	244
Trieste–Opcina–Piedicolle	108
Prevacina–Aidussina	15
Trieste–S. Pietro del Carso–Postumia	107
S. Pietro del Carso–Fiume	60
Voghera–Milan	54
Voghera–Piacenza	55
Broni–Bressana	13
Milan–Chiasso	52
Pisa–Florence	79
Viareggio–Pistoia	66
Pisa–Lucca	24
Aula–Monzone	16
Lucca–Castelnuovo	45
Bologna–Padua–Mestre–Trieste	294
Mestre–Venice	8
Monfalcone–Gorizia	21
Carano–Naples	81

control to two or three, or in some cases four, economical speeds. Starting is effected by means of rotor rheostatic control. The difficulties have, however,

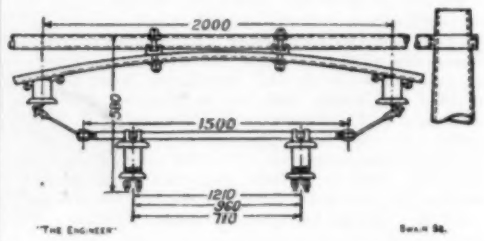


FIG. 2—3-PHASE LOW VOLTAGE CONTACT LINE SUSPENSION

been overcome, and the three-phase system is still being extended in Northern Italy. In the neighbourhood of Rome experiments have recently been made with the high-voltage three-phase system at standard frequency; while south of Rome the latest installations employ direct current at 3000 volts

From the economic point of view, the difference between the three-phase and the high-voltage, direct-current systems is negligible. In Italy at the present time only 16 or 17 per cent. of the total cost of working represents expenditure upon which the system employed might have some influence. A difference in this figure is thus insignificant as a fraction of the total cost. Regarded in this light, it will be seen that any other detail of the working may have a greater economical importance than that of the electric system employed. It is believed that the desirability of having a single system over the whole, or, at any rate, over integral parts, of the railway network is of greater economic importance.

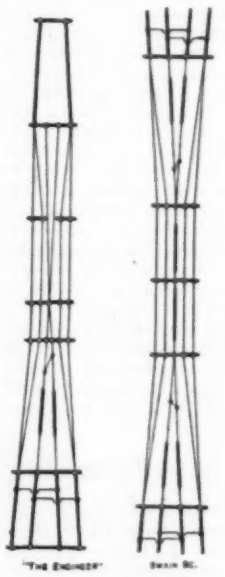


FIG. 3—JUNCTION AND CROSSING, 3-PHASE CONTACT LINE

Technical Details of the Three-phase System.—Apart from the Milan–Varese railway and more recent experimental sections, all the lines electrified by the Italian State Railways administration are equipped with three-phase gear at 3000 to 4000 volts between phases, and 15 to 16⅔ periods. The adoption of this low frequency at the beginning of the century enabled locomotives to be built without gears, which at that time were undeveloped for heavy locomotives.

The electrical energy is generated direct at low

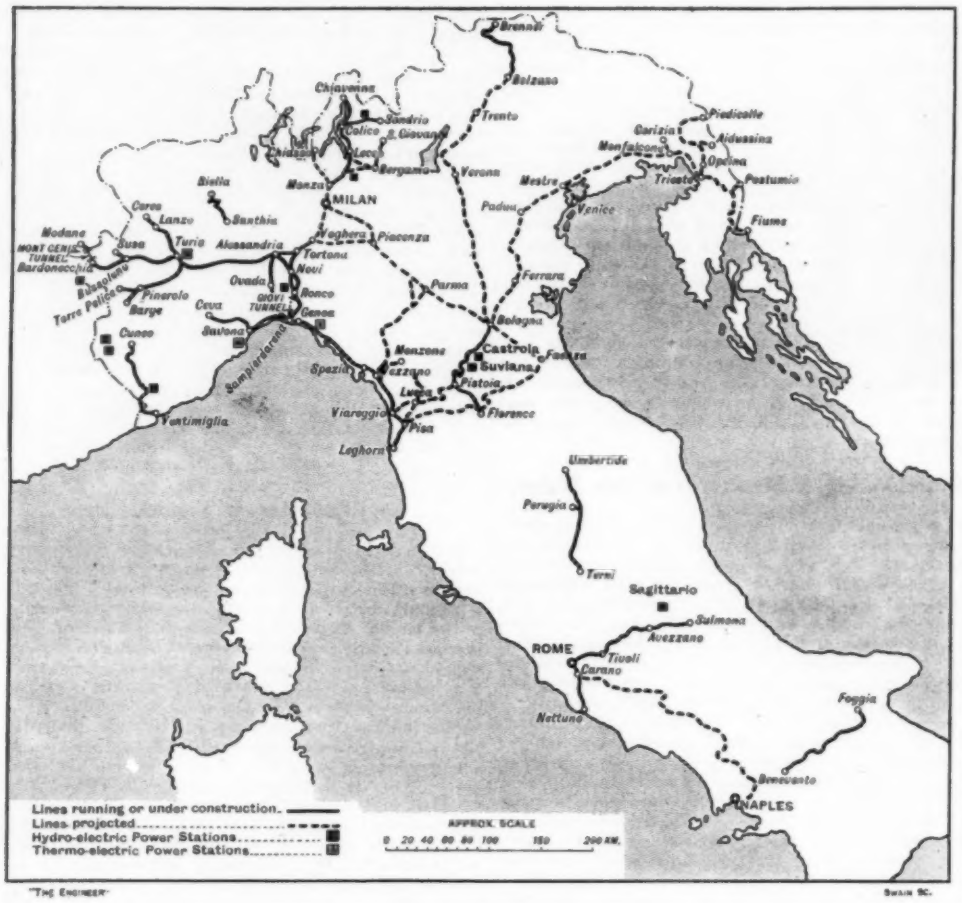


FIG. 1—ELECTRIFIED RAILWAYS IN ITALY

* Nos. I., II. and III. (Switzerland) appeared June 6th, 13th and 20th, 1924; Nos. IV. and IVA. (Scandinavia) appeared January 23rd and February 6th, 1925; Nos. V. and VI. (Germany) appeared June 5th and 12th, 1925; Nos. VII. and VIII. (Austria) appeared August 21st and 28th, 1925; Nos. IX. and X. (France) appeared October 2nd and 23rd, 1925; Nos. XI. and XII. (U.S.A., North-Western States) appeared February 12th and 26th, 1926; No. XIII. (U.S.A., South-Eastern States) appeared March 26th, 1926; Nos. XIV., XV. and XVI. (U.S.A., North-Eastern States) appeared November 26th and December 3rd and 10th, 1926.

TABLE IV.—ITALIAN MAIN LINE RAILWAY ELECTRIFICATION

			GENERAL.									CONTACT LINE.					POWER SUPPLY.						
Railway.	No.	Section.	Date opened for electric traction.	Route length. km.	No. of tracks	Gauge, m.	Max. gradient °/₀₀	Min. curve radius, m.	No. of stations.	Mean distance between stations, km.	Rail weight, kg./m.	Current, voltage, frequency	Contact line.	Return	Contact line suspension	Description and spacing of supports.	No. of feeding points.	Feeding points.	Mean distance between feeding points, km.	Feeding lines.	Transmission lines.	Power stations.
ITALIAN STATE RAILWAYS	1	Milan – Varese – Porto Ceresio	1901	72	1 and 2	1·435	20	300	17	4·2	36·1	D.C. 650 V.	Third-rail, top contact, 45 kg./m.	Track bonded	Porcelain insulators	0·143 m. above track, spaced 4·5 m.	7	*Converter sub-stations*— 1,600 kW. each	10·3	Lines at 45,000 V, 42 cycles from Gallarate to each sub-station	Power stations to Gallarate sub-station at 45,000 V., 42 periods	*Deveira* and *Cairasca* [hydro-electric] stations of the Milan Dynamo Co.
	2	Monza – Lecco – Colico – Sondrio and Colico – Chiavenna (Valtellina)	1901	143	1	1·435	20	200	39	3·7	36·1	3-ph., 3,400 V., 15 per.	Double overhead conductors, 200, 100, and 50 mm².	Track (third phase)	Simple suspension from poles	8 m. above track, spaced about 35 m.	15	*Transformer sub-stations*— 23,710 kVA. installed capacity	9·5	—	Power stations to Morbegno and Usmate sub-stations at 20,000 V. All sub-stations interconnected at 20,000 V.	*Morbegno* [hydro-electric] of the State Railways and *Robbiate* [hydro-electric] of the Milan Edison Co.
	3	Turin – Modane (Mt. Cenis) and Bussoleno–Susa	1914 1919	108	2 1	1·435	30	350	20	5·9	46·3 to 50·6	Three-phase, 3,400 volts, 15–16⅔ periods	Double overhead conductors, 200, 100, and 50 mm².	Track (third phase)	Simple suspension from poles or cross-wires	8 m. above track, spaced about 35 m. on open track	5	*Transformer Sub-stations*— kVA. Bardonecchia 4,500 Oulx .. .. 3,000 Chiomonte .. 3,000 Bussoleno .. 2,500 Avigliana .. 3,000	21·6	3-ph. feeding line along track, Bardonecchia to eastern portal of Mt. Cenis tunnel	Associated transmission lines of the State Railways, the Maira Co., and Negri Co.	
	4	Turin–Pinerolo	1917	37	1 2	1·435	13	600	9	4·1	36·1 to 46·3						2	*Transformer sub-stations*— kVA. Sangone .. .. 4,500 Airasca 2,500	18·5	3-ph. feeders between Airasca–Pinerolo, Sangone–Lingotto, and Lingotto – Turin		*Prazzo* and *Acceglio* [hydro-electric] of the Maira Co., *San Dalmazzo* [hydro-electric] of the Negri Co., *Bardonecchia* [hydro-electric] of the State Railways, *Chiomonte* [hydro-electric] of the city of Turin, *La Chiappella* [steam] of the State Railways, *Savona* [steam], and certain others
	5	Savona–Ceva	1911	46	1	1·435	25	400	12	3·8	50·6						5	*Transformer sub-stations*— Lavagnola, Sella, San Giuseppe, Saliceto, Ceva: 16,500 kVA installed capacity	9·2	—		
	6	Ronco – Busalla – Sampierdarena: Ronco – Mignanego – Sampierdarena – Genoa, &c. (Giovi)	1910	60	2	1·435	35	400	—	—	50·6						8	*Transformer sub-stations*— kVA. Ronco .. .. 5,400 Busalla .. .. 1,500 Montanesi .. 2,000 Pontedecimo .. 2,000 Rivarolo .. .. 2,000 Mignanego .. 4,200 San Quirico .. 1,800 Sampierdarena 5,400	7·5	16,000-V, 3-ph. line along Genoa–Busalla–Ronco line: 30,000-V, 3-ph. cables along Genoa – Mignanego–Ronco line		
	7	Savona – Sampierdarena	1916	40	1	1·435	7	240	13	3·1	46·3						2	*Transformer sub-stations*— kVA. Voltri .. .. 3,000 Varazze 3,000	20	—		
TURIN–LANZO RAILWAY	8	Turin – Lanzo – Ceres		43	1	1·435	35	200	—	—	30 to 36	D.C. 4,000 volts	Steel catenary wire 60 mm². copper contact wire	Track	Simple catenary	Wood poles, spaced 50 m.	1	*Motor generator sub-station*, Cirie, 3-ph., 500-V. syn. motor driving two 2000-V., 325-kW d.c. generators	43	Feeder from Cirie to Ceres, 60 mm²	—	*Funghera* [hydro-electric] or *Turin* [steam] of the Alta Italia Co.
VALLE BREMBANA	9	Bergamo – S. Giovanni Bianco		30	1	1·435	24	150	—	—	—	1-ph., 6,000 V., 25 per.	Simple catenary	Track	—	—	—	—	—	—	—	*Camerate Comello* [hydro-electric]
STRADE FERRATE DEL MEDITERRANEO	10	Terni–Umbertide and Ponte S Giovanni–Perugia		113	1	1·435	20 60	300 250	— —	— —	— —	1-ph., 11,000 V., 25 per.	Simple catenary	Track	—	—	—	—	—	—	—	*Papigno* [hydro-electric]

frequency, machines for traction being as a rule separate from the ordinary industrial supply. Low-frequency energy is naturally associated with smaller line drop, and requires smaller conductors on account of the reduced impedance compared with normal 50-cycle supply. In some cases, the primary mains, leaving a mixed frequency station, are available for either frequency, allowing the use of a single reserve main. Conversion of traction to industrial frequency, or *vice versâ*, is sometimes effected with the generators themselves, when the latter are on the same shaft; one of the generators being worked as a synchronous motor. Load factors may be improved in this way.

Owing to the high cost of labour in transformer sub-stations, the tendency has been to use as few as possible and to provide portable sub-stations on special railway coaches in case of need. The primary mains are thus of necessity laid alongside the railway tracks. Transformer sub-stations are usually provided with switchgear for cutting out sections of the contact wires or the primary mains. This somewhat expensive arrangement has been found to be justified by the reduction in operating costs which it provides.

The 3-phase system requires two overhead lines and at junctions and crossings the double wire introduces complication—see Figs. 2, 3, 5, 6 and 7. In general, simple suspension of the contact wires is used without any catenary. The reason for this is simplicity. The lateral supports, however, cannot be much more than 35 m. apart. In all cases the system has been kept as simple and inexpensive as possible consistent with efficiency, making for easy maintenance and inspection. The simplicity of the three-phase induction motors, together with their mechanically robust construction, enables three-phase locomotives to be lighter and simpler than with any other system. Most of the Italian locomotives are required to have an axle load not exceeding 15 tons, and a drawbar pull of not more than 10 or 12 tons. As many lines are steeply graded, the deadweight must therefore be kept small.

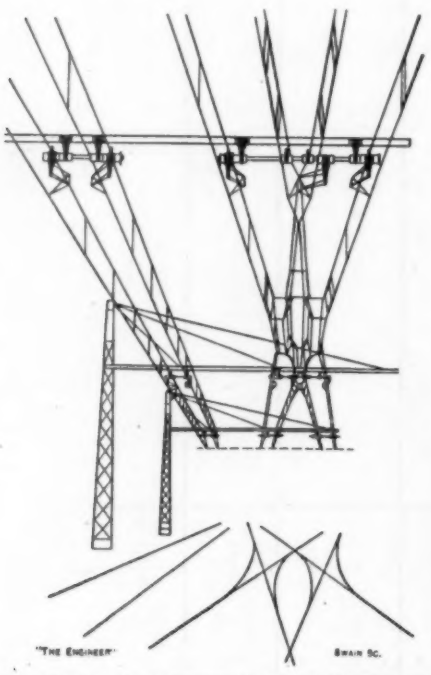


FIG. 5—CATENARY CONSTRUCTION, 3-PHASE CONTACT LINE

3. EXTENT OF THE PRESENT ELECTRIFICATION.

The maps in Figs. 1 and 4, showing Italy as a whole, and the northern parts respectively, indicate the extensive electrification scheme proposed for the future, together with the lines already operating. Details of the latter are given in Table IV., page 31.

(To be continued.)

IT is officially announced that Lieut.-Colonel G. L. Hall has been appointed assistant engineer (Signals and Telegraphs) Southern Railway. Colonel Hall has been one of the inspecting officers of railways since 1919, and his new appointment is in succession to Mr. W. J. Thorrowgood, who is retiring on reaching the age limit.

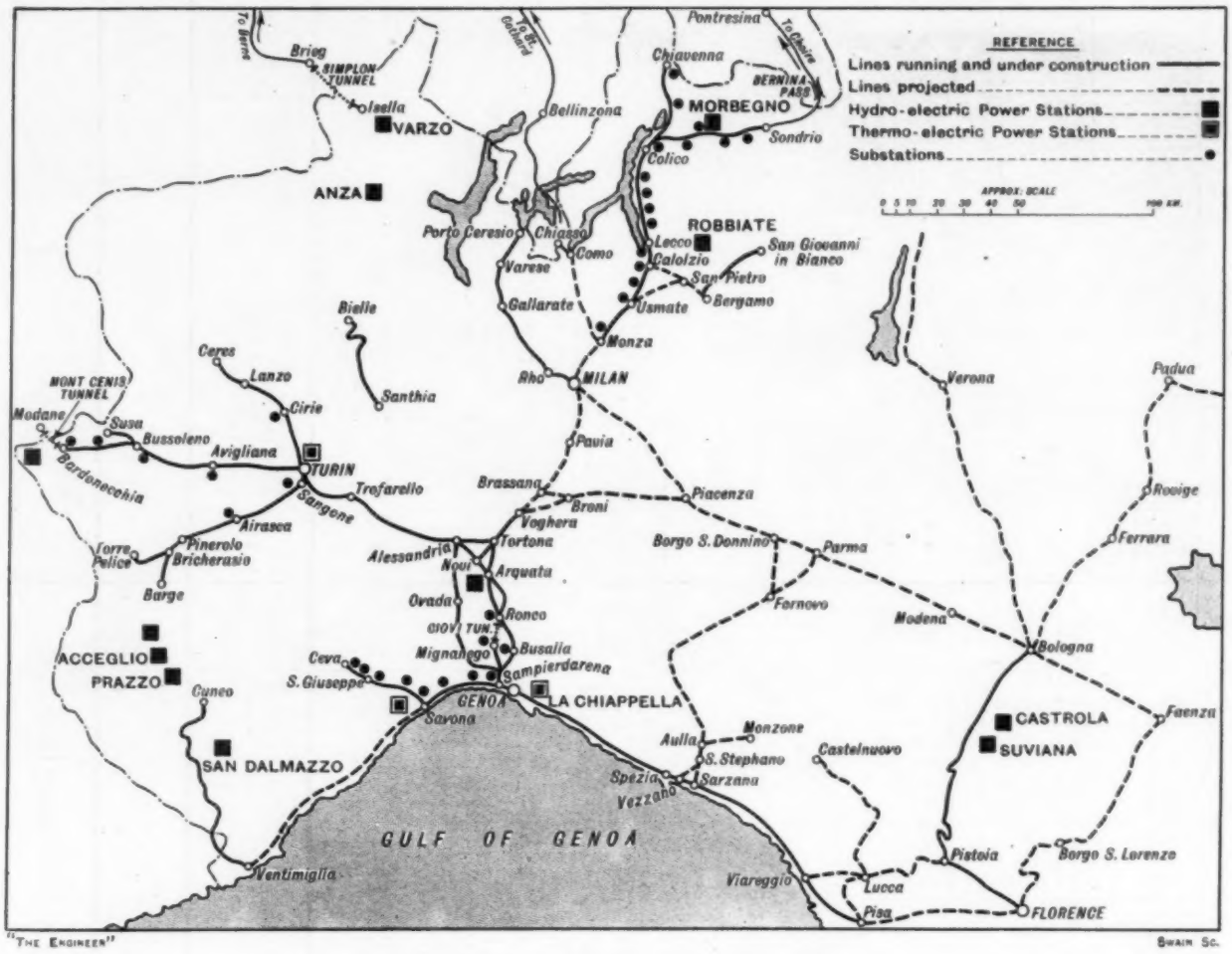
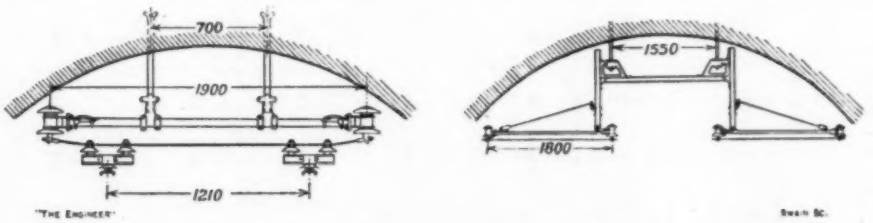


FIG. 4—ELECTRIFIED RAILWAYS IN NORTHERN ITALY



FIGS. 6 AND 7—SINGLE AND DOUBLE TRACK CONSTRUCTION, GIOVI AND MT. CENIS TUNNELS

The Merwedekanaal Power Station.

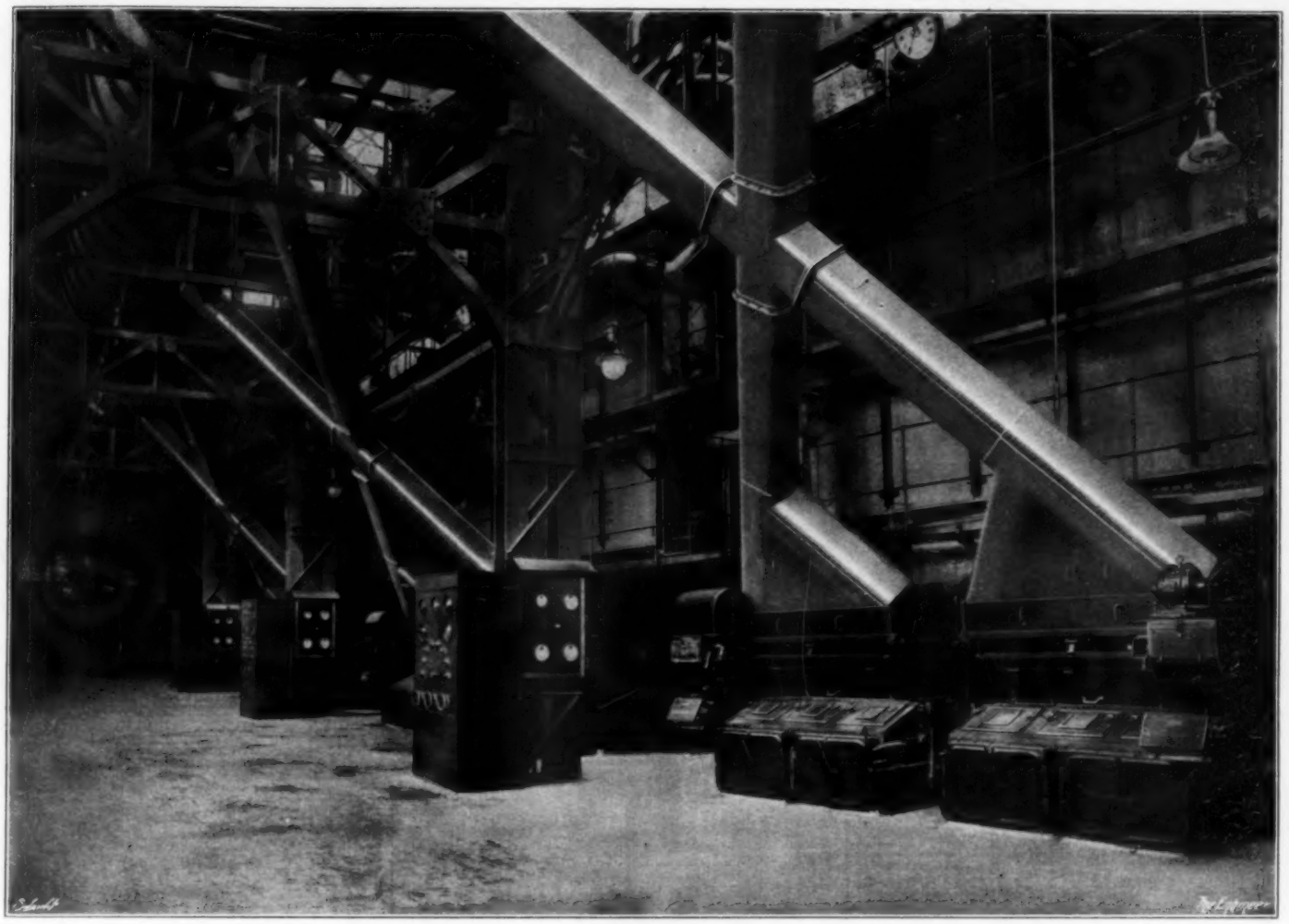
No. I.

IN the design of the recently completed Merwedekanaal Power Station at Utrecht a very high thermal efficiency was aimed at. With this end in view the use of steam at a pressure and temperature well in advance of ordinary practice was decided on and the equipment of the station generally was ordered in accordance with the same idea. The working pressure chosen for the boilers was 36 atmospheres, or 512 lb. per square inch, with a steam temperature of no less than 800 deg. Fah. At the time the station was designed, in 1924, there was probably no higher steam pressure and temperature in commercial use on the Continent of Europe, and even to-day the conditions, particularly as regards temperature, are highly exceptional. The first generating unit to be installed comprised a turbine of the Stork-Erste-Brunner design rated at 16,000 kilowatts capacity. The four boilers to supply steam to this set were constructed, like the turbine itself, by Messrs. Stork Brothers, of Hengelo, Holland, by whose courtesy and with the kind permission of Dr. J. J. L. Smits, director of the Merwedekanaal station, we are able to publish a full description of the design and performance of this interesting plant.

The boiler-house, the general arrangement of which is illustrated in Fig. 1, contains altogether five boilers, the four high-pressure units with which this article is concerned standing side by side and occupying completely one side of the firing aisle, as shown in the longitudinal section. The other boiler, seen on the left in the cross section, is of the Babcock and Wilcox L.T.M. type. It works at a pressure of 300 lb. per square inch and serves to supply steam to certain machinery taken from the old power-house and re-erected at Merwedekanaal. It will not be further mentioned. A good idea of the boiler-house will be

MERWEDEKANAAL POWER STATION—INTERIOR OF BOILER-HOUSE

DR. J. J. L. SMITS, UTRECHT, ENGINEER



gathered from the illustration above, which is a view taken in the firing aisle looking towards the high-pressure boilers. The excellent natural illumination of the house will be noticed as well as the modernity of the equipment, each boiler having its operating and instrument panel and each chain grate is illustrated in the drawing on page 34. The boiler, which is of the Babcock and Wilcox high-duty marine type, is equipped with economiser, superheater, and air heater, and is fired by a pair of chain grate stokers. The normal rate of evaporation is 44,000 lb. of steam per hour, and, as will be seen by the particulars of the in the same steel casing, which is lined with heat-insulating material, and protected outside against radiation losses by a sheet iron covering. There are altogether thirteen water tubes to a section of the boiler, a lower bank of six rows and an upper bank of seven rows. Between these two banks the

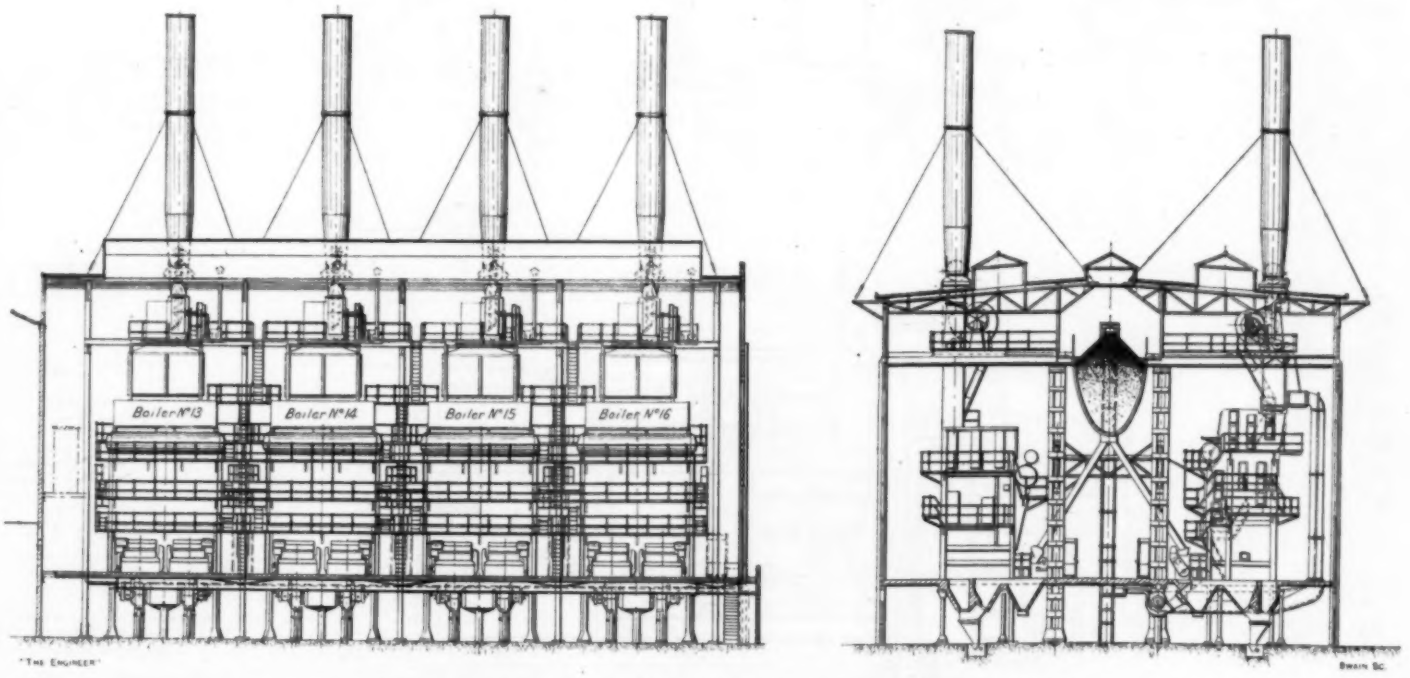


FIG. 1—SECTIONS THROUGH BOILER-HOUSE AT THE MERWEDEKANAAL POWER STATION

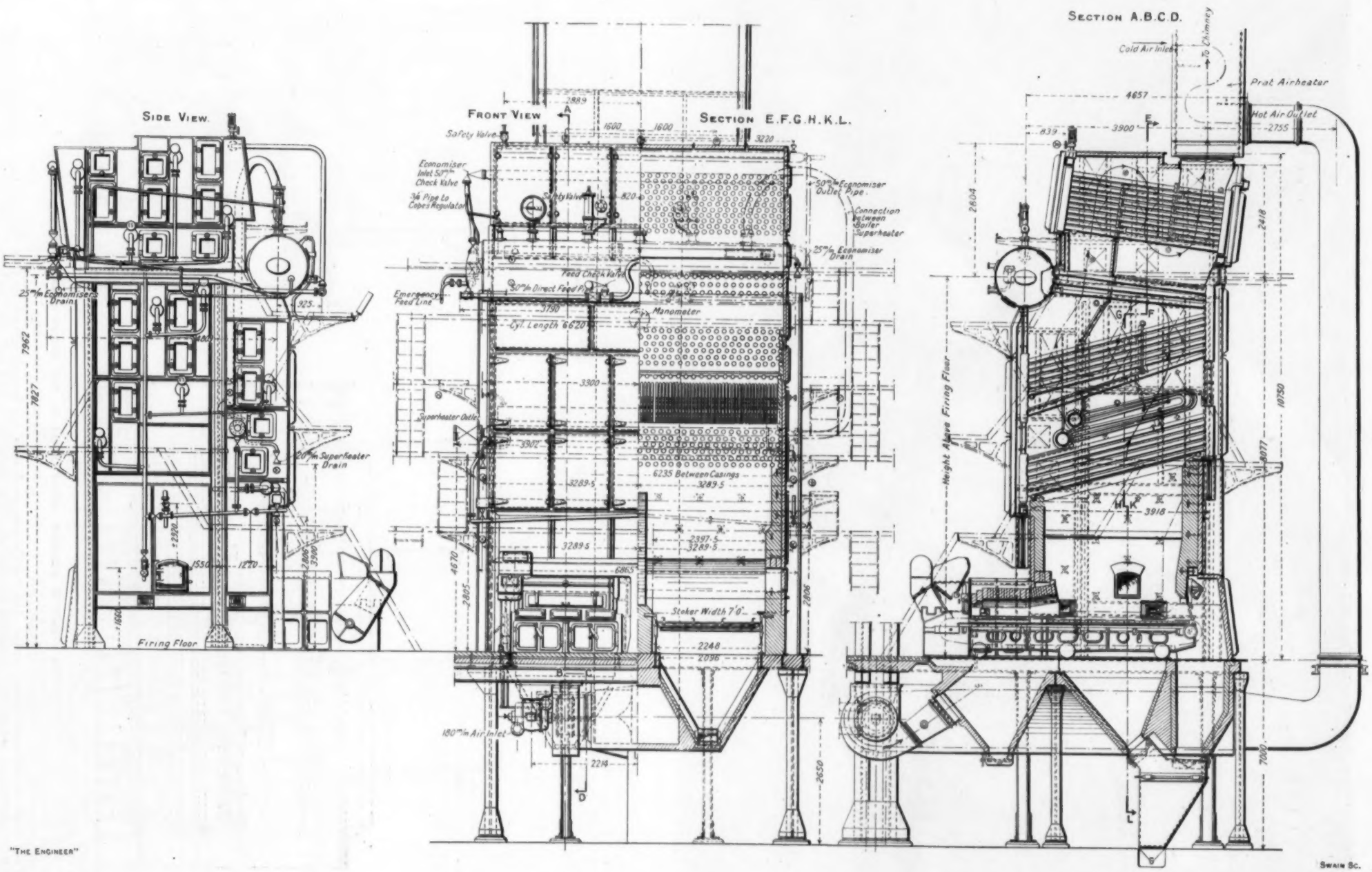
being fitted with a Lea coal meter. The same impression of cleanliness and good illumination is given by Fig. 2, which shows the induced draught fans and gallery, with the boiler tops and economisers below.

The design of one of the high-pressure boiler units is illustrated in the drawing on page 34. The boiler, which is of the Babcock and Wilcox high-duty marine type, is equipped with economiser, superheater, and air heater, and is fired by a pair of chain grate stokers. The normal rate of evaporation is 44,000 lb. of steam per hour, and, as will be seen by the particulars of the official tests given later, at a load slightly greater than this, an overall efficiency of 87·6 per cent. has been obtained, computed on the net calorific value of the coal. The leading particulars of the boiler are given in Table I. below.

Each complete boiler and economiser is contained in the same steel casing, which is lined with heat-insulating material, and protected outside against radiation losses by a sheet iron covering. There are altogether thirteen water tubes to a section of the boiler, a lower bank of six rows and an upper bank of seven rows. Between these two banks the superheater is placed. This low position for the superheater is indicated for two reasons: first, in order to secure the high steam temperature of 800 deg. Fah., and secondly, in consideration of the fact that the temperature of the steam will be more stable at varying loads as heat transmission is effected both by

MERWEDEKANAAL POWER STATION—HIGH-PRESSURE BOILER UNIT

MESSRS. STORK BROTHERS, HENGELO, HOLLAND, ENGINEERS



radiation and by convection. The economiser is of the ordinary superposed type with steel tubes. The stokers

TABLE I.

Normal evaporative capacity, lb. per hour	44,000
Maximum evaporative capacity, lb. per hour	48,500
Load on boiler safety valve, lb. per sq. in.	512
Temperature of steam, deg. Fah.	800
Heating surface of boiler, sq. ft.	6,420
Heating surface of economiser, sq. ft.	3,800
Heating surface of superheater, sq. ft.	1,666
Heating surface of air heater, sq. ft.	5,270
Total grate area, sq. ft.	224
Number of sections in boiler	37
Number of tubes per section	6 + 7 + 3
Length of tubes, ft.	13
External diameter of tubes, in.	3·25
Number of sections in economiser	37
Number of tubes per section	11
Length of tubes, ft.	11
External diameter of tubes, in.	3·25
Width of each stoker, ft.	7·0
Length of each stoker, ft.	16·0

are of the well-known Babcock and Wilcox forced draught type with totally enclosed fronts. They are

FIG. 2 INDUCED DRAUGHT FANS AND GALLERY

provided with special air distributing arrangements patented by Messrs. Stork Brothers, enabling the air pressure to be regulated along the whole length of the grate. A further modification of Messrs. Babcock and Wilcox's usual practice has been made in respect of the dumping bars. These have been replaced by hanging dumping bars suspended immediately behind

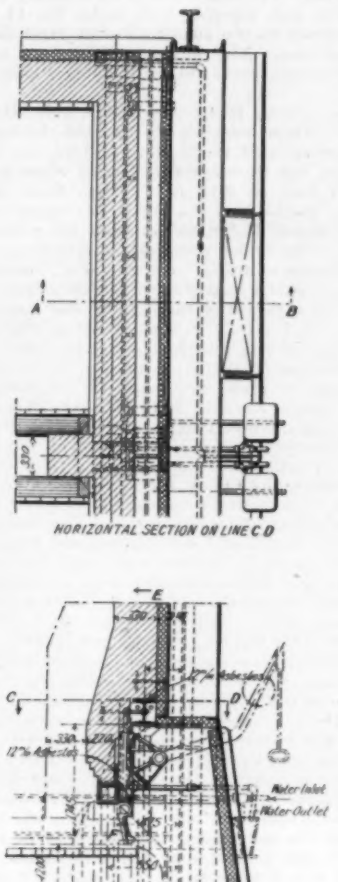


FIG. 3—ARRANGEMENTS AT BACK OF BOILER FURNACE GRATE

a square cast iron water-cooled pipe running across the grate at the back. The bars, which form a sort of hanging curtain, serve to check the ashes and thus to keep the rear end of the grate fully covered, besides preventing the direct admission of air over the back of the fire. They can be raised by a lever at the back of the boiler setting, the mechanism being shown in Fig. 3.

Balanced draught is provided for the furnaces. There is a forced draught fan for each stoker, the two fans with their motors being hung underneath the firing floor and discharging their air directly into their respective ashpits. They draw air through a Prat plate-type air heater placed above the economiser, the air duct passing down at the back of the boilers, as shown in the cross section in Fig. 1. In this heater the air for combustion is raised about 117 deg. Fah. in temperature, normally from 77 deg. Fah. to 194 deg. Fah. Some performances of these air heaters on test are given in Table IV. Above the air heater on each boiler is the corresponding induced draught fan and motor. These fans draw the flue gases through the economisers and air heaters and discharge them to the steel stacks. Each boiler unit is equipped with a "Diamond" soot blower, with ten elements a side, for cleaning the outsides of the boiler, superheater and economiser tubes. A "Cope" feed water regulator provides for the automatic maintenance of the water level in each boiler. Ashes and clinkers are removed by a water trough system. They are shot from the ashpits into a cast iron gutter in which they are swept away to a dump by high-pressure jets of water. The design of this ash disposal plant was due to Mr. Van Noppen, the manager of the Amsterdam refuse destructor plant.

GUARANTEES AND TESTS.

Each boiler unit was guaranteed to produce 44,000 lb. of superheated steam at 500 lb. pressure and 800 deg. Fah. temperature at the stop valve, with an overall efficiency of 84·5 per cent. For the overload rating of 48,500 lb. per hour the efficiency guaranteed was 81 per cent. These guarantees were subject to the air for combustion being heated from 77 deg. Fah. to 194 deg. Fah. and coal being used having a net calorific value of 12,960 B.Th.U. per

TABLE II.—*Results of Official Tests on Boilers Nos. K14 and K15.*

Test No.	1	2	3	4	5
Number of boiler and load	K15—normal load	K14—normal load	K14—overload	K14—three-quarter load	K14—half load
Date of test	July 6th, 1926	July 9th, 1926	July 9th, 1926	July 10th, 1926	July 10th, 1926
Beginning and end of test	12.01¼ p.m. to 7.55¼ p.m.	10.15 a.m. to 6.14 p.m.	6.50 p.m. to 7.54 p.m.	9.45 a.m. to 10.01 p.m.	1.48 p.m. to 5.58 p.m.
Duration of test	474 min.	479 min.	64 min.	196 min.	250 min.
FEED WATER:					
Evaporation per hour	22,887 kg.	21,972 kg.	24,795 kg.	15,208 kg.	10,035 kg.
Evaporation per hour per m.² heating surface	38·3 kg.	36·8 kg.	41·5 kg.	25·5 kg.	16·8 kg.
Mean temperature before economiser	82·6° C.	85·3° C.	85·7° C.	83·0° C.	84·8° C.
Mean temperature behind economiser	157·7° C.	153·0° C.	158·0° C.	149·4° C.	154·3° C.
Evaporated per kg. coal	9·667 kg.	9·52 kg.	9·98 kg.	9·63 kg.	9·65 kg.
STEAM:—					
Mean pressure	33·1 kg./cm.²	32·8 kg./cm.²	33·1 kg./cm.²	32·1 kg./cm.²	32·0 kg./cm.²
Mean temperature of saturated steam	239·9° C.	239·4° C.	239·9° C.	238·2° C.	236·1° C.
Mean temperature of superheated steam	410·2° C.	414·5° C.	417·7° C.	399·5° C.	388·3° C.
HEAT TAKEN UP PER KG. STEAM:—					
In economiser, cal.	159·1 − 82·6 = 76·5	154·2 − 85·3 = 68·9	159·4 − 85·7 = 73·7	150·5 − 83·0 = 67·5	155·6 − 84·8 = 70·8
In boiler for evaporation, cal.	666·7 − 159·1 = 507·6	666·7 − 154·2 = 512·5	666·7 − 159·4 = 507·3	666·7 − 150·5 = 516·2	666·7 − 155·6 = 511·1
In superheater, cal.	775·5 − 666·7 = 108·8	778·0 − 666·7 = 111·3	779·4 − 666·7 = 112·7	770·0 − 666·7 = 103·3	764·0 − 666·7 = 97·3
Total, cal.	692·9	692·7	693·7	687·0	679·2
FUEL:—					
Calorific value	7,647 cal.	7,561·5 cal.	7,561·5 cal.	7,625·5 cal.	7,625·5 cal.
Coal fired	18,760 kg.	18,550 kg.	2,940 kg.	5,250 kg.	4,410 kg.
Fired per hour, riddlings deducted	2,366 kg.	2,308·5 kg.	2,760 kg.	1,580 kg.	1,039 kg.
Fired per hour per m.² grate surface	114 kg.	111 kg.	132·5 kg.	76 kg.	50 kg.
ASH, RIDDLINGS AND ASH PLATES:—					
Total ash and clinker	1,132 kg.	1,131 kg.	—	—	—
Combustible percentage in ash	8·44 kg.	6·26 kg.	—	—	—
Riddlings at end of test (this is deducted from fuel used)	100 kg.	133 kg.	—	—	—
Calorific value of riddlings	5,820 cal.	5,436 cal.	5,436 cal.	5,980 cal.	5,980 cal.
Water for ash plates	55,035 kg.	26,470 kg.	9,570 kg.	6,875 kg.	9,450 kg.
Water for ash plates per hour	7,338 kg.	3,309 kg.	8,203 kg.	2,118 kg.	2,363 kg.
Mean temperature of water before ash plates	14° C.	14° C.	14° C.	14° C.	14° C.
Mean temperature of water after ash plates	53·7° C.	70·5° C.	42° C.	54·4° C.	41·3° C.
HEAT ACCOUNT:—					
Heat taken up by evaporation in boiler	4907·1 = 64·17%	4879·0 = 64·32%	4555·5 = 60·25%	4971·0 = 65·19%	4932·1 = 64·67%
Heat taken up by superheater	1051·9 = 13·76%	1059·6 = 14·01%	1012·1 = 13·38%	994·8 = 13·05%	938·9 = 12·31%
Heat taken up by economiser	739·6 = 9·67%	656·0 = 8·68%	661·8 = 8·75%	650·0 = 8·52%	683·2 = 8·96%
Heat taken up by complete plant	6698·6 = 87·60%	6594·6 = 87·21%	6229·4 = 82·38%	6615·8 = 86·76%	6554·2 = 85·94%
Losses in the flue gases	523·8 = 6·85%	491·8 = 6·49%	584·8 = 7·73%	471·8 = 6·19%	593·5 = 7·78%
Heat taken up in ash plates	124·0 = 1·62%	81·0 = 1·07%	83·2 = 1·10%	54·2 = 0·71%	62·1 = 0·81%
Losses unburnt coal in ash	32·8 = 0·43%	24·9 = 0·33%	664·1 = 8·79%	483·7 = 6·34%	415·7 = 5·47%
Losses by radiation (rest)	267·8 = 3·50%	369·2 = 4·90%			
	7647·0 = 100·00%	7561·5 = 100·00%	7561·5 = 100·00%	7625·5 = 100·00%	7625·5 = 100·00%

pound. The coal was further stipulated to have a volatile content of at least 20 per cent. and to be supplied as nuts, containing not more than 10 per cent. of pieces which would pass a ¼in. screen.

Two boilers, listed officially as K14 and K15 were designated by the directors for test. The object of the tests was to determine the efficiency of these boilers at normal load, but further tests were carried out on boiler K14 under overload, three-quarter load, and half-load conditions. Every possible care was taken to render the tests accurate. The coal was weighed on a scale immediately before being put into the hoppers of the stokers. The feed water was measured by means of a special "Kent" Venturi meter. This meter was itself tested with special care before being used, first at the works of George Kent, Ltd., and subsequently on site in the power station under the conditions of pressure and temperature of water which would prevail in the boiler tests. Temperatures were measured partly by the existing operating instruments and partly by mercury thermometers and pyrometers specially obtained for the work. All instruments were calibrated before use. The percentage of CO_2 in the flue gases was measured at the inlet side of the induced draught fans by means of a Siemens CO_2 meter, a Duplex-Mono apparatus, and an Orsat apparatus. Steam pressure readings were taken from the ordinary boiler gauges and draught measurements were made by means of U tubes filled with water. The cooling water used for the dumping bars was measured by a water meter and its temperature noted.

The fuel used was a mixture of Dutch coals, Emma nuts V. and Laura nuts IV. being mixed in equal proportions. Samples of the fuel were taken during each test. These samples were thoroughly mixed and afterwards divided amongst three bottles. One bottle was analysed in the laboratory of the power station, the second in the laboratory of Messrs. Stork Brothers, and the third was kept in the power station for reference if needed. In calculating the test figures the average of the two analyses was taken, as the results were sufficiently in agreement with each other to justify that course. In order that the reader may form a judgment on the fuel used, we publish in Table III. the results of the analysis in Messrs. Stork Brothers' laboratory.

TABLE III.—*Fuel Analyses made by Messrs. Stork Brothers.*

Fuel used on / Boiler number / Nature of test	6/7/1926 K 15 Normal load	9/7/1926 K 14 Normal and maximum loads	10/7/1926 K 14 Half and three-quarter loads
Percentage of—			
Moisture	2·30	2·60	2·45
Ash	6·80	7·88	7·87
Volatile matter	17·80	17·27	17·30
Carbon	81·65	79·50	80·10
Hydrogen	4·33	4·23	4·24
Sulphur	0·81	0·92	0·82
Nitrogen and oxygen (rest)	4·11	4·87	4·52

The quantity of ash and clinker was weighed during the tests at normal load. The quantity of riddlings in the front ashpit was very small and was thrown back into the hoppers during the tests, as would be the practice in daily operation of the plant. The riddlings which were found in the front ashpit at the end of the test were weighed and a sample taken to determine the calorific value. A calculation was then made of the quantity of fresh coal which would have the same calorific value as the riddlings, and this quantity was deducted from the quantity of fuel put into the hoppers, to arrive at the true weight of fuel burnt. It was in this manner that the figures were obtained which are given in the Table II. showing the test results. As regards the ashpit losses, an average sample of the ash and clinker was taken and tested both in the power station laboratory and in that of Messrs. Stork Brothers. The mean value of these two analyses was taken in computing the figures in the table.

The official test of boiler No. K15 took place on July 6th, 1926. The boiler was in its ordinary working condition and, together with boiler No. 14, was supplying steam to the 16,000-kilowatt Stork-Erste-Brunner turbine. The measurements were taken over a continuous period of eight hours starting at noon.

The tests of boiler K14 took place on July 9th and 10th, 1926. These were also carried out during the ordinary operation of the boiler. A start was made on July 9th, the measurements lasting eight hours, from 10.15 a.m. to 6.15 p.m. Then from about 7 to 8 p.m. the load on the boiler was raised to an average of about 54,500 lb. per hour for a further short trial. The boiler remained in operation until 7 a.m. the next morning. On that day, Saturday, July 10th, a test at a load of about 33,500 lb. per hour was made for a period of three hours and a-quarter from 9.45 to 1 p.m. Finally, later in the day, a further test lasting four and a-quarter hours was made at a load of 22,000 lb. per hour.

The results of these five tests will be found in Tables II.—page 35—and IV. Table IV. contains a calculation of the heat taken up by the air in the air heater. The calculation of the quantity of flue gases and of the air is based on the analysis of the fuel and on the percentage of CO_2 in the flue gases. We give the data of these tests in their original metric form because the Centigrade thermometer is now becoming so general in all thermal calculations and there are obvious objections to bastard units such as pound-calories, &c. For the convenience of those who desire to make the conversion to British units we may remind them that 1 kilo. is equal to 2·204 lb., 1 calorie to 3·968 B.Th.U., 1 kilo. per square centimetre to 14·223 lb. per square inch, and 1 kilo. per square metre to 0·2048 lb. per square foot.

We have already mentioned the boiler efficiency guaranteed by the makers, and it will be seen from the tests that the guarantees were fully realised. The tests of both boilers gave practically the same result, namely, 87·6 per cent. and 87·2 per cent. on full load, against a guaranteed efficiency of 84·5 per cent. As it is feasible to utilise the heat taken up by the water used to cool the ash plates, that heat may be fairly credited to the boiler, and the efficiencies then become 87·6 + 1·62 = 89·22 per cent. for boiler No. K15 and 87·21 + 1·07 = 88·28 per cent. for boiler No. K14. The efficiencies for loads lower than the rated capacity were also very satisfactory, a figure of 85·94 being obtained at half load. In considering the tests it may be mentioned that the feed water, which enters the economiser at 85 deg. Cent., is raised to that temperature regeneratively by steam bled from the main turbine.

As regards the working of the plant, in spite of the high pressure and temperature of the steam, we believe that no technical difficulties of any kind have arisen, the joints and packings being kept tight without trouble. The boiler drums were made with riveted seams, the greatest attention being paid to the workmanship and all rivets, even of both circumferential seams, being closed hydraulically. The manufacture of seamless boiler drums has, however, advanced so rapidly recently that drums of this latter kind are being used by Messrs. Stork Brothers for four boilers for the same pressure of 500 lb. per square inch now in hand. These boilers, which are being constructed for another power station, will each have an evaporative capacity of 55,000 kilos. (121,000 lb.) of steam per hour.

We shall deal with the Erste-Brunner-Stork turbine at Merwedekanaal in a subsequent article.

(To be continued.)

TABLE IV.—*Official Tests on Boilers Nos. K 14 and K 15: Results of Test on Air Heater.*

Test No. / Number of boiler and load / Date of test / Beginning and end of test / Duration of test	1 K 15—normal load July 6th, 1926 12.01½ p.m. to 7.55½ p.m. 474 min.	2 K 14—normal load July 9th, 1926 10.15 a.m. to 6.14 p.m. 479 min.	3 K 14—overload July 9th, 1926 6.50 p.m. to 7.54 p.m. 64 min.	4 K 14—¾ load July 10th, 1926 9.45 a.m. to 1.01 p.m. 196 min.
FLUE GASES—				
Mean temperature in front of air heater	220·1° C.*	236·8° C.	265·7° C.	204·9° C.
Mean temperature behind air heater	165·9° C.	160·7° C.	178·4° C.	137·4° C.
Average percentage of CO_2 behind air heater	12·4%	12·3%	11·9%	10·8%
Flue gases per kg. coal	17·42 kg.	17·18 kg.	17·69 kg.	19·48 kg.
Specific heat of flue gases	0·255	0·255	0·255	0·255
Heat transferred per kg. flue gases		19·4 cal.	22·3 cal.	17·2 cal.
Heat transferred per kg. coal		333·3 cal.	394·5 cal.	335·0 cal.
AIR—				
Mean temperature in front of air heater	35·6° C.	35·8° C.	35·0° C.	32·5° C.
Mean temperature behind air heater	113·4° C.	112·9° C.	123·0° C.	104·3° C.
Air used per kg. coal	16·47 kg.	16·24 kg.	16·75 kg.	18·35 kg.
Specific heat of air	0·24	0·24	0·24	0·24
Heat taken up per kg. air	18·7 cal.	18·5 cal.	21·1 cal.	17·2 cal.
Heat taken up per kg. coal	308·0 cal.	300·4 cal.	353·4 cal.	319·1 cal.
EFFICIENCY—				
Heat taken up by air in proportion to calorific value of coal	4·02%	3·97%	4·66%	4·18%

* As the loss of temperature of the flue gases in this test is not likely to be correct, in view of the results of the other tests, these figures have not been used in the calculations.

IT is proposed to construct a high-level bridge across the Buffalo River, at East London, at a cost of some £114,000.

High-grade Manganese in South Africa.

THE discovery of platinum in the Union of South Africa has had other and almost equally beneficial results for the country. It gave a stimulus to prospecting which has led to several important discoveries, among which may be mentioned two tin occurrences which seem likely to become substantial producers. Another is a huge deposit of manganese ore with high metallic content. It was at first estimated that the content was about 20,000,000 tons, but it is now established that even 50,000,000 tons is a conservative estimate. The importance of this deposit was at once recognised by American steel interests, which dispatched experts to the site to investigate, analyse, and test the ore. These investigations have been successful, and the American interests have accordingly acquired, on a royalty basis, a considerable area.

The importance of manganese for steelmaking need not be emphasised, and it will be well if British manufacturers give this new deposit as early and careful attention as the American steel people have done, and so assure themselves of ample supplies for many years to come.

The existence of manganese ores in the neighbourhood of Postmasburg appears to have been recognised for the first time by Captain T. L. H. Sloane, while prospecting on the farm Doornfontein. Subsequent work has demonstrated that the deposits persist over many miles of country as rich ores available in quantities sufficient to furnish an important industry. The occurrences lie in the northern portion of the Cape Province, and extend almost without a break from a point about five miles north-west of Postmasburg in a northerly direction across the division of Hay into the division of Kuruman—formerly part of British Bechuanaland—and their strike thus measures nearly 40 miles in a direct line.

Dr. A. L. Hall, assistant director of the Geological Survey, says in his report, published last year, that the manganese ore bodies can be traced almost without interruption northwards as far as the farm Bruce. Situated some 40 miles almost due north of Bruce, and separated from the latter locality by a stretch of superficial deposits of sand, gravels, and surface limestone, lies a small but conspicuous landmark known as the "Black Rock." This is a remarkable hillock some 80ft. high and surrounded by sand; it is about 400 yards long and 150 yards wide. The Black Rock consists of hard variegated jaspers, containing magnetite and layers of manganese.

Dr. Hall's main conclusions are summarised as follows:—"The bulk of the ore is psilomelane, and forms a sheet up to some 20ft. thick interbedded in slates and ferruginous conglomerates, dipping to the west at low angles. The deposit indicates a ferro-grade ore; it contains from 42 to 58 per cent. of metallic manganese, no phosphorous, from 1·75 to 7·0 per cent. of silica, and from 3·25 to 10·9 per cent. of iron."

"Based on an average thickness of 4ft. there are approximately 900,000 long tons in sight in the form of residual cappings due to the removal by denudation of the overlying sediments. Along the outcrop of the reef where it passes westwards under the Matsap Beds, a further 1,800,000 long tons are in sight, based on an average thickness of 8ft. and on an exploitation over 10ft. on the dip. Further development down to a depth of 100ft. on the dip would yield an additional approximate supply of 18,000,000 long tons on the same basis of average thickness. Owing to a minor folding the ore body occurs in several outliers, and is locally duplicated or triplicated, the extra supplies thus afforded are additional to the above. The nearest railhead is Douglas, distant 65 miles from Postmasburg."

The largest and most important manganese undertaking operating in the Postmasburg district is the Union Manganese Mines and Minerals (South Africa), Ltd. It was formed in February, 1926, with a capital of £12,500, in 5s. shares, all of which is issued. The company has secured 45 miles, a large portion in freehold, of the pick of the manganese belt, and has carried out a great deal of prospecting work on its holding. In addition to the manganese the company holds five farms, three of which are freehold, in the asbestos belt which lies to the east of the manganese belt, and is producing asbestos. It has also struck a promising deposit of galena on one of its farms. As regards the company's manganese interest, a report by Dr. Hall, not yet published, shows that prospecting operations have been extended and maintained over a large number of points, where the ore body has been opened up by means of shallow pits or shafts, trenches and cuttings. These workings have a maximum depth of about 12ft., and mostly fall within the southern section—i.e., within the farms Olynfontein, Beeshoek, Doornfontein, Paling and Driehoekspan. On Beeshoek alone, for example, are some twenty of such shafts, together with several trenches. These workings are spread out all along the strike at intervals of about 100ft. and upwards, so that over the farms mentioned an absolute continuity for no less than ten miles is now conclusively demonstrated along the strike. In Dr. Hall's earlier report the southern limit of the manganese body was shown to be in Beeshoek, but exploratory prospecting has now proved the ore body to extend across the adjoining farm Olynfontein, which means about 2½ miles of additional strike.

Dr. Hall's first estimate of the available tonnage—20 million tons—was based on the assumption that the ore body would persist on the dip for 100ft. so that an annual production of 500,000 tons would mean a life of forty years for the deposit. Later evidence show that this period is vastly greater. The excellent physical condition was found to be fully maintained in all the recent workings that he saw. Dr. Hall's criticism leads to the conclusion that the southern section of the field is somewhat higher in grade than the northern. The average of 103 assays, representative of the whole field, is 46·70. The lowest of these assays is 23·1, and the highest 59·2. Assays of 48 per cent. and over number fifty-three out of the 103, or 51 per cent. of the samples, and assays of 55 per cent. and over number eight out of 103, or 7·7 per cent. of the samples. An assay certificate from Messrs. Sydney Bilbrough and Co., Johannesburg, describes the Postmasburg manganese ore as "a high-grade manganese ore characterised by:—(1) Absence of titanium; (2) low phosphorus; (3) high metallic manganese."

SUCTION GAS TRACTOR WITH PARKER PRODUCER HAULING 3-FURROW PLOUGH

PETER BROTHERHOOD, LTD., PETERBOROUGH, AND J. AND F. HOWARD, LTD., BEDFORD, ENGINEERS

Tractor Ploughing with Producer-Gas.

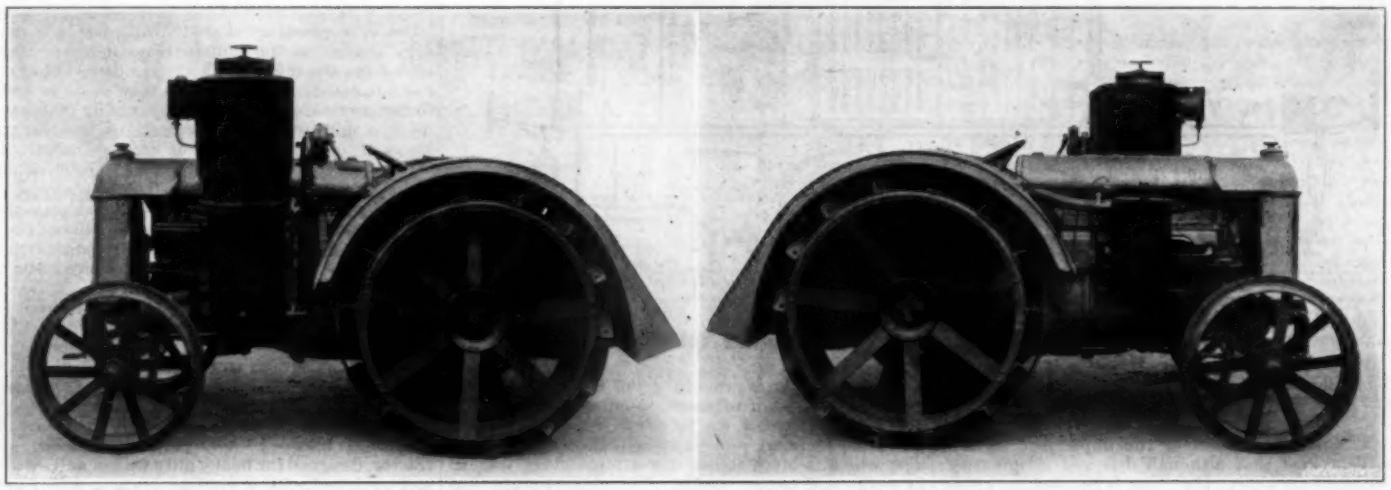
On Wednesday, June 29th, we attended a ploughing trial at Perivale, near Ealing, which had been arranged by the Parker Producer-Gas Plant Company, of 170, Piccadilly, W. 1, to demonstrate the practicability of using charcoal fuel on agricultural tractors, and the high efficiency of working which is now to be obtained by the use of high compression.

As our readers are aware, the question of employing agricultural and other tractors equipped with producer gas plants has for some time now been attracting a good deal of attention in France. Liquid fuels cost so much in out-of-the-way places that it is economically impossible to employ them, whereas, in many parts of the world, there is wood that can be readily and cheaply turned into charcoal by unskilled native labour. A successful demonstration of the operation of wood-carbonising plants and producer-gas tractors was recently held in the neighbourhood of Blois—see THE ENGINEER for May 6th and 13th last—and the trials at Perivale were, we understand, chiefly arranged with the object of showing representatives from the Overseas Dominions, Dependencies and Colonies that British engineers are also prepared to supply vehicles which will operate successfully with charcoal gas producers.

The gas producer associated with the name of Colonel Parker was originally designed some years ago, and the Parker Producer-Gas Plant Company, the proprietor of which is Motor Owners' Petrol Combine, Ltd., has now acquired the patent rights of the Parker-Bamber and Jones systems of producer gas working as applied to mechanical transport. It is claimed that by using compression pressures some 50 per cent. higher than those commonly employed with paraffin fuel, it is now possible with the new Parker plant to compensate for the lower calorific value of producer gas and thus to make it possible to employ tractors at high altitudes.

The first tractor to be shown in operation was the Peterbro-Parker machine, illustrated above, which drew a three 9in. furrow plough made by Howards, of Bedford. The tractor itself is manufactured by Peter Brotherhood, Ltd., of Peterborough, and has been specially designed for producer gas working and for heavy duty. The ground on which the trial was made was unbroken and consisted of a good loam. The tractor unit was engaged in ploughing three furrows with an average depth of 7¼in., which it did without effort in both bottom and top gears. The engine is of the Ricardo type, and it has four 4¼in. bore cylinders with a stroke of 5½in. It is designed for an output of 30 B.H.P. when running at 900 r.p.m. on producer gas, and the engine, we are informed, has been proved to produce the same amount of power on gas fuel as when working with paraffin. Our engraving shows the general arrangement of the gas plant. The fuel hopper, which is circular in shape, with a slightly sloping bottom, has a capacity of from 50 lb. to 70 lb. of charcoal fuel, which is sufficient for three to four hours' working, depending upon the quality of the charcoal employed and the horse-power being developed. The hopper is arranged immediately above the producer, which is lined with a refractory material and provided with a fire-door and ashpan in the base, which are normally sealed by a light removable cover. Attached to the producer is a vertical preheater of tubular construction, on the top of which is fixed a hand-driven fan. The preheater consists of an outer tube, through which the hot gases are drawn, and which surrounds an inner tube through which the supply of air is delivered to the producer. A water tank is attached to one side of the hopper, and a finely adjustable water drip fitting delivers water to the one inlet tube. On leaving the preheater the gas passes through a flexible metal tube to a scrubber, which consists of a rectangular box containing coke and furnished with baffles that throw down most of the dust. The gas is finally delivered through another flexible tube to a filter which is arranged near the induction manifold. This filter again is a welded steel box with an air mixer valve, which is worked by a Bowden wire control. By this means both the extra air and the gas are filtered before passing into the engine cylinders. The filter comprises a compartment filled with horse-hair, also a filter pad, after which the gas is washed by passing over a water film. An arrangement for starting up on petrol is fitted on the induction manifold.

The producer was started up from cold, and after running for a few minutes on petrol the tractor was ready for work in twenty minutes. We inspected the scrubber and filter after two hours' working and there was only a small amount of dust present. The ash in the producer pan was also negligible. The fuel employed was a ¾ charcoal screened to remove dust.



FORDSON TRACTOR FITTED WITH PARKER GAS PRODUCER

The lower views show the Parker producer, as fitted to the standard Fordson tractor, which was also exhibited, and attached to a two 9in. furrow plough of the Oliver type. This set, though it was on the site, did not take part in the trial. With the Oliver plough a neat arrangement of the plant is possible, as the scrubber can be accommodated at the back of the driver's seat. With a Ferguson plough, however, the scrubber is placed on one of the wing guards of the tractor. A special Parker cylinder head of a protected design for high-compression working is fitted to the 20 B.H.P. Fordson engine, and is claimed to make the output of the engine on gas equal to that when running on paraffin fuel.

The various engines were noticeably quiet when running on gas fuel, and they appeared to possess ample power for the work. The new high-compression cylinder head to which we have referred is now being applied by the Parker Company to other commercial vehicles of approved design, and also to road rollers.

OIL-DRIVEN SHUNTING ENGINE

JOHN FOWLER AND CO. (LEEDS) LTD., ENGINEERS

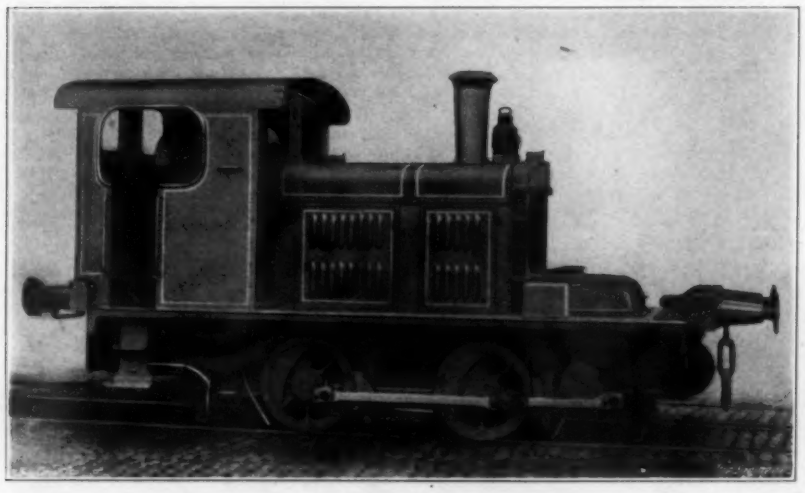


FIG. 13

The Royal Agricultural Society's Show at Newport, Mon.

No. II.*

THE site of the present Show, which opened on Tuesday last, is Viscount Tredegar's deer park at Bassaleg, a beautiful setting with historical associations and within a very short distance of the ancient British camp known latterly as Tredegar Fort, which has been preserved by Viscount Tredegar. The camp is 300ft. above sea level and measures 370 yards by 270 yards, with a double line of ramparts and trenches. Few more pleasant situations have been found for the Show. The implement section, which is smaller than usual, has been laid out in a triangular portion of the ground near the entrance, but on the opening day, owing to heavy rain, the condition of the surface was unpleasant. The attendance of the public was much below the average, owing partly to the unfavourable weather, but there was a good attendance of colonial agriculturists, chiefly from South Africa.

Continuing our review of the implement section, it may be said that although deficient in quantity, the engineering side of the Show is not lacking either in the quality of the exhibits or in originality, for there are several quite new appliances which deserve notice.

No name is more familiar in the implement section of the Royal Show than that of John Fowler and Co., Ltd. This Leeds firm holds an almost unique position in the agricultural world for heavy ploughing plant, and particularly for that form of cultivation known as the double engine cable system. Formerly steam was the only medium used for that class of work, but in recent years the crude oil engine has come into vogue, and Messrs. Fowler have on exhibition a 70 horse-power engine of that type, as well as a motor roller, a steam roller, and a more recent development in the form of a shunting locomotive 4ft. 8½in. gauge, the motive power for which is supplied by an oil engine. We give illustrations of this locomotive in Figs. 13 and 14. It is of 0–4–0 type, with wheels 30in. diameter, a wheel base of 4ft. 6in., an overall length of 19ft. 7in., width 7ft. 1in., and height 9ft. 8in., the total weight being 9 tons. The motor is of the four-cylinder vertical pattern, with cylinders 4½in. diameter by 6½in. stroke. It is arranged about midway above and between the coupled driving wheels, and in the opposite direction to that adopted in orthodox motor car practice, and the starting handle is inside the driver's cab. The drive is taken from the engine by a single plate clutch and shaft to a three-speed gear-box; the gears of which are of the constant mesh type, and run in oil. Gear changing is effected by dog clutches, and the three speeds are operative in each direction. The bevel drive to the cross-shaft, in which is embodied the reversing gear, is carried in a separate box. There are no chain drives, and consequently no adjustments for stretch. The frame is built up of steel plates in a manner similar to that employed for an ordinary steam locomotive, and the wheels, axles, axle boxes, coupling rods, buffers, &c., also follow orthodox locomotive practice. A powerful hand-screw brake is provided to all wheels, and it can be supplemented, if required, by air pressure brakes. There is a bollard at the forward end of the locomotive; and there are pulleys at each end for rope haulage, which is often found useful for moving wagons in works and factory yards. The makers state that this engine will haul a train weighing 350 tons on the level and 110 tons up a gradient of 1 in 100 on a properly laid track. The engine exhibited was built to the order of Courtauld's, Ltd.

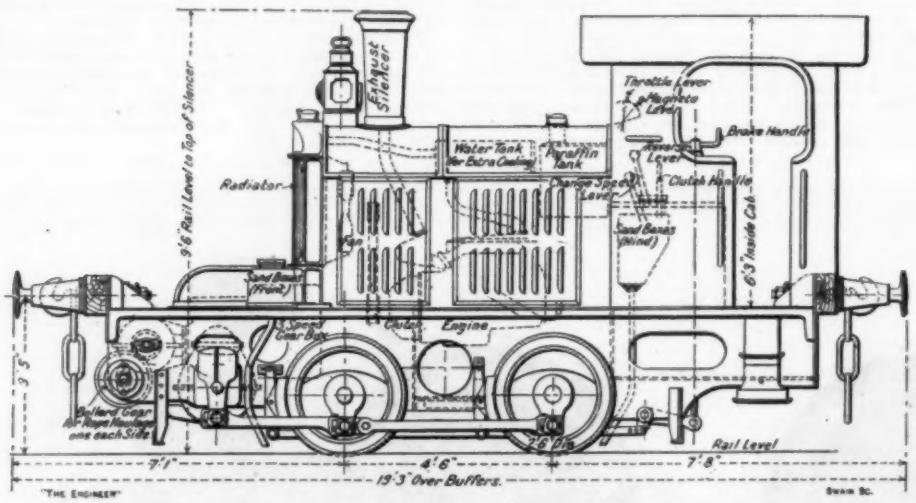


FIG. 14—ARRANGEMENT OF OIL-DRIVEN SHUNTING ENGINE—FOWLER

The 70 horse-power cable ploughing engine, shown by Messrs. Fowler, is fitted with a high-speed Diesel motor built by the M.A.N. Co. In this connection Messrs. Fowler's attitude to the crude oil engine may be stated as cautious. They admit that it shows an undoubted saving in fuel cost, but state that the cost of fuel is by no means the whole cost of working, and they point out that if low cost be obtained at the expense of reliability, or if expert attention is necessary to keep the machinery at work, it may be that the saving in fuel will not be justified. Messrs Fowler have, so they inform us, tested these engines for prolonged periods and obtained consumptions varying from 0·45 lb. to 0·50 lb. per B.H.P. hour according to the load, so that, apart from the lower cost of the fuel the quantity used is over 30 per cent. less than petrol. Other advantages claimed for this type of engine are:—(1) The engines will start from dead cold without the need of any heating apparatus; (2) starting troubles associated with Diesel engines have been eliminated; (3) the injection nozzles are of the simplest possible type without any valves or springs, and they can be removed or replaced almost as easily as the sparking plugs in an ordinary motor car; (4) provision is made for cutting out any number of cylinders as required, so that for running light only one or two cylinders can be left working, and greater economy of fuel obtained in consequance.

A prominent feature on the stand of Ruston and Hornsby, Ltd., is the small enclosed type of petrol-paraffin engine, an illustration of which is given in Fig. 15. It is a farmers' engine of the hopper-cooled type in which the exhaust valve is operated by a push rod, and the air valve is automatic. It is made in sizes from 1½ to 6 B.H.P., and weighs from 210 lb. to 870 lb., according to its power. The latest improvements in this engine are the fitting of an enclosed splasher over the crank case and a large end bearing to keep out dust and dirt. The latter is a good feature when the engine is used for dusty work in connection with farm elevators. A hand hole is provided in a convenient position on the top of the splasher for lubricating the large end bearing. The engine shown is a 2½ brake horse-power, the normal running speed being 560 revolutions per minute. This firm also exhibits binders, threshing machines, mowing machines, ploughs, tractors, and a petrol-paraffin driven excavator mounted on a "caterpillar" travelling gear, which can be operated by one man, and has an output of 20 to 40 cubic yards per hour.

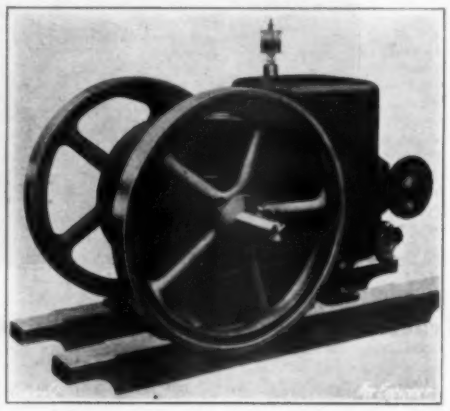


FIG. 15—PETROL-PARAFFIN ENGINE—RUSTON & HORNSBY

The Perfection Milking Machine, shown by Gascoignes, Ltd., Reading, embraces an improvement in the shape of a two-piece teat-cup which has the considerable advantage that it can easily be taken apart for cleaning. This cup comprises only two parts, a metal shell and a rubber centre-piece, which latter is so constructed that it operates in a manner very similar to the human hand in extracting the milk from the udder of the cow. The rubber centre piece is constructed in such a way that, in addition to the suction created by the pumping plant, it produces a downward spiral squeeze on the teat which strips it of all the milk at each pulsation, while, at the completion of this process, the internal rubber member completely collapses below the teat, thus breaking the vacuum and giving the same action as that of the sucking calf. This action allows the milk cistern just above each teat to fill again with milk ready to be drawn out by the suction of the next pulsation.

The Sentinel Waggon Works, Ltd., of Shrewsbury, generally has some interesting application of the steam engine to farm and road purposes, and this year is no exception to the rule. The exhibits comprise:—A 6–7-ton three-way tipping wagon; a 15ft. 3in. flat platform lorry; a 17ft. flat platform lorry with a curtained canopy, the capacity being seventeen barrels; a large-wheeled double-geared tractor, designed for heavy duty timber and farm work and equipped with a winding drum and belt pulley; and a single-gear small-wheel tractor for road haulage. The use of the Super-Sentinel two-cylinder power unit, employing double-acting high-pressure cylinders of 6½in. diameter by 9in. stroke, is standard, though in the case of the large-wheel tractor a few modifications are found. Outstanding features of this engine are (*a*) the crank case oil bath; (*b*) the use of poppet valves and push rods, with separate steam and exhaust push rods; (*c*) double packing glands between the cylinder and the crank case, which obviate condensation affecting the oil bath contents; and (*d*) a differential incorporated in the crank shaft to save back axle unsprung weight. The cranks are at right angles. At 12 miles per hour the engine speed is only 300 r.p.m.

The crank shaft is bored out through its entire length to accommodate at each end the floating shafts which transmit the power to the chain sprockets mounted on the ends of the crank shaft. On the inner end of each floating shaft a gear wheel is rigidly

* No. I. appeared July 1st.

secured, and it meshes with a pinion cut from the solid bar on a shaft housed inside either crank pin. The inner ends of these shafts also carry gear wheels which mesh with one another. They are inside the crank throws, and the combination forms the differential train. The bearings, differential wheels and the valve cam shafts, of course, run in oil. The two inlet and two exhaust valves to each cylinder are all placed at one end of the cylinders; they may be removed on the unscrewing of four nuts. The valves are made of stainless steel, are especially designed for use with superheated steam, and are push-rod operated.

The boiler is of the vertical, quick-steaming type, supplying steam at 230 lb. pressure and at 150 deg. Fah. superheat. The inner shell or fire-box contains three banks of steeply inclined tubes. The design eliminates the need for boiler stays, while the fire-box may be dropped by breaking two joints. The double-coil type superheater is fitted in the top part of the fire-box. Exhaust steam is utilised in a feed-water heater, bringing the water before admission to the boiler practically to 212 deg. Fah.

In this firm's tipping wagon the angle of tip is 41 deg. In the tipping gear used, water from an injector is admitted under pressure to a cylinder by means of a short, stout, spherical-ended connecting-rod. The body itself is pivoted at both sides and at the rear, and on the withdrawal of appropriate pins will tip to right, left, or rear. When side tipping, the sides fall down, so as to ensure that the load passes clear of the rear wheels and mudguards. The tail-board can also swing away on hinges.

The small-wheel road tractor also exhibited by the Sentinel Company weighs under 6 tons and is designed for handling heavy loads along moderately good roads. The wheel base is 8ft. 6in., the overall height 9ft., and the overall length 15ft. 3½in. Manœuvring is stated to be easy. The design of the tail, which encloses a 225-gallon water tank, is most noticeable. A 10–12-ton trailer may be hauled. There is the advantage that in the event of loading or unloading delays the tractor may be uncoupled and used to haul a ready loaded trailer.

Hitherto, Fodens, Ltd., Sandbach, has confined its productions to the overtype steam wagon, but in order to satisfy those of its clients who prefer machines of the undertype variety, it is now producing a wagon of the undertype shaft driven variety, illustrations of which are given in Figs. 16 and 17. The engine is of the double-acting high-pressure type, with two cylinders, 7in. bore by 10in. stroke, fixed horizontally across the frame. The steam and exhaust valves are operated by a cam shaft, which moves horizontally, giving three forward speeds, one reverse speed and a neutral position. The cam shaft is driven from the crank shaft by spiral gears supported on roller bearings. The crank case, which is made of cast steel, carries at the front the cast steel end casing which has formed on it a spherical bearing, to which is secured a supporting bracket on the main frame. Fixed to the rear of the crank case is a cast steel rear case, which carries two double-helical steel gear wheels, one mounted on the crank shaft and the other on the gear shaft. These two gear wheels are made to fit either the crank shaft or the gear shaft, so that if at any time a slower speed ratio is required, the gear wheels are interchangeable. The drive from the gear shaft is through two universal joints and a propeller shaft to a steel worm which transmits movement to a bronze worm wheel carrying differential gear and driving the floating rear axle in the axle casing. The engine is suspended from the chassis frame by two spherical bearings, one on a crank case end cover and the other on the gear case, these bearings allowing some slight movement to take place between the engine and the frame. A strong suspension eye bolt passes between the two slides, and is fixed at the front to a cross channel to the frame. The above are the only three connections between the engine and the frame, and their employment renders it an easy matter to drop the engine down for inspection, &c. An adjustable wind screen is fitted at the front of the cab for protection of the driver from the weather and the front plate round the boiler is slightly hollowed out inside to give the driver a full view of the road. Electric light is provided on the wagon, and the dynamo, which is fitted on a bracket underneath the main frame, is driven by means of a belt and split pulley which is fixed on the gear shaft between the gear case and the universal joint. This dynamo charges an accumulator under a platform. We understand that Messrs. Foden have made some strenuous tests with this wagon, with most satisfactory results, both for speed, economy of fuel and silence when running.

On the stand of Crossley Bros., Ltd., Manchester, is a large and representative collection of crude oil engines, paraffin engines, small pumping units, and an electric lighting set. The majority of the exhibits are shown in motion. The crude oil engines are of 62, 20, 14, 10, and 6 B.H.P. There is also a 7½ B.H.P. paraffin engine, a 6 B.H.P. petrol-paraffin engine of the enclosed type and two smaller engines of similar construction. The cold-starting engine is designed to operate upon the cheapest grade of fuel oil as well as Diesel and semi-refined fuel oil, and the fuel consumption, according to information received from the makers, is 0·40 lb. and 0·42 lb. per B.H.P. hour for full and three-quarter load respectively. There are four examples of this firm's two-stroke vertical oil engines from 6 to 20 B.H.P. The outstanding feature of these engines is the separate air scavenge pump, of which our readers are already familiar. Pump lubrication is provided for the main bearings and removable parts. These engines are started up by means of a heating lamp, but they can be started from cold by means of a self-lighting burner which we described in last year's article on the Agricultural Show. The 7½ B.H.P. paraffin engine shown in operation has magneto ignition and petrol starting attachment. A large number of new Crossley small engines of the enclosed type, of 2, 3, and 6 B.H.P., is shown working. As small engines for use on the farm these constitute ideal small power units. They are of the petrol-paraffin type, totally enclosed, with a continuous system of lubrication. The crank shaft bearings and gearing are completely protected from dust and dirt, and yet the removal of a few nuts gives easy access to the parts within. The enclosed crank case allows of a sump lubricator being fitted, which automatically lubricates the main bearings, connecting-rod, gears and piston, and avoids that constant attention which is otherwise required when single lubricators are provided on the engine. Increased efficiency is obtained from the use of mechanically operated valves. A detachable cylinder is provided and the engine is started up on petrol and changed over quickly to paraffin, although either paraffin or petrol may be used as desired.

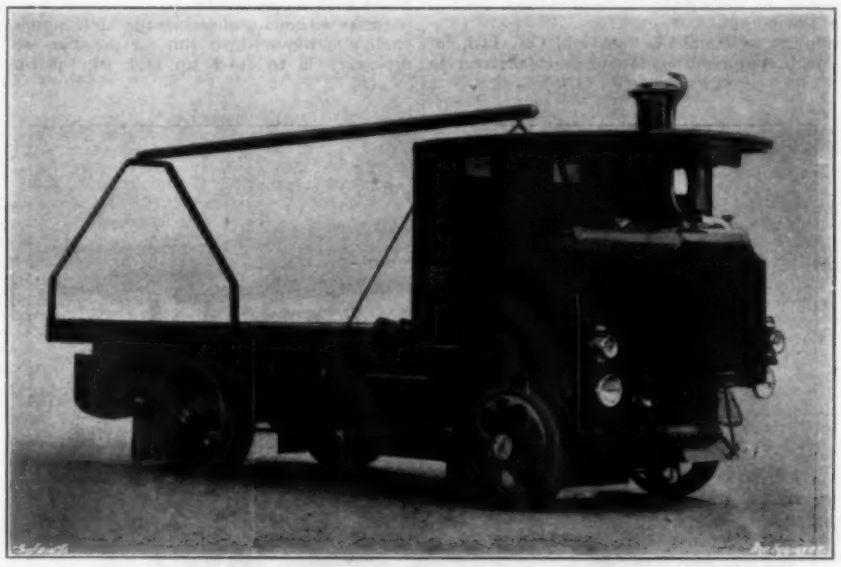


FIG. 17—6-TON UNDERTYPE STEAM WAGON—FODENS

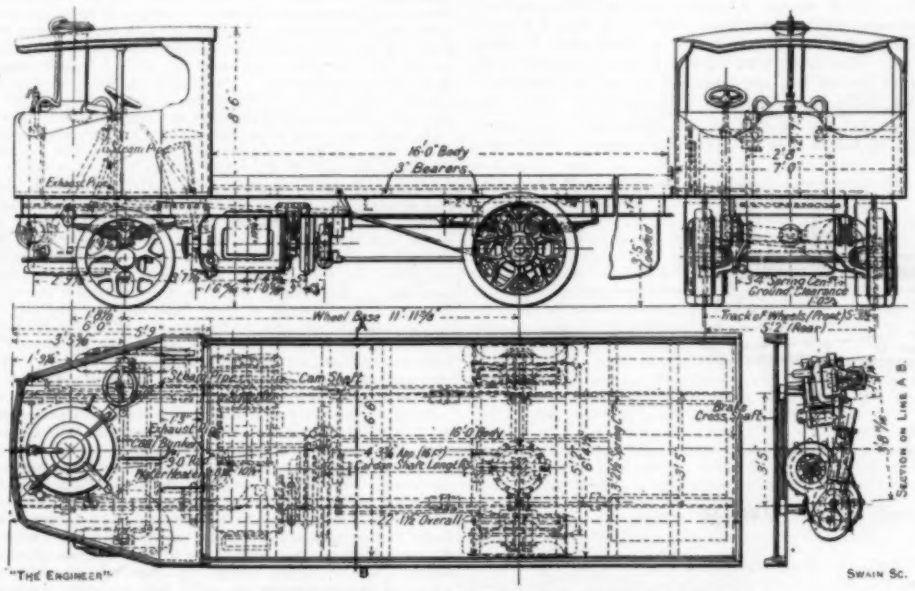


FIG. 16—ARRANGEMENT OF 6-TON STEAM WAGON—FODENS

Another interesting exhibit by Crossley Brothers and others is the automatic heavy oil electric generating set shown on the stand of the Electrical Development Association. The engine consists of a Crossley two-stroke vertical oil engine, which develops 20 B.H.P. as a normal working load at a speed of 400 r.p.m. This engine is directly coupled to an electric generator. One of the chief features of the engine consists of a positive system of air scavenging. The lubrication is fully automatic by means of a pump delivering lubricating oil under pressure to all the main bearings and moving parts. The engine is fitted with an electrically heated ignition plug to allow of immediate starting up from cold, after which ignition is automatic from the heat of compression inside the engine. The combustion chamber is completely water cooled and a Heenan and Froude water cooler is used to cool the circulating water. The electric generator is made by the British Thomson-Houston Company, Ltd., of Rugby, and is direct coupled to the engine. To start the engine power is drawn from the storage battery, which is an essential feature of the plant, and the dynamo, acting as a motor, turns the engine until firing commences. The automatic switchboard, which was made by the Austin Lighting Company, Ltd., of Banbury, controls the operation of the plant in a manner that is almost uncanny. As soon as the storage battery needs recharging the automatic controller sets in motion a drum type switch. In starting up the plant the drum moves three times at intervals of fifteen seconds. At the first move the electrically heated ignition plug is switched on, at the second move the engine is set in motion and commences firing, at the third the plug is switched off again, and the engine continues to work, firing by the heat of compression. The plant continues to charge the battery until it is fully charged, when the drum switch—still operating automatically—makes two more moves. The first reduces the output of the dynamo and the last move entirely disconnects it from the battery and stops the engine by cutting off the fuel. Throughout this charging period the voltage on the supply cables is kept constant, in spite of the continually rising voltage of the battery, by an ingenious automatic regulator switch, which cuts cells out of the supply circuit as required to compensate for the increase of the voltage of the cells as they become more fully charged. After the plant has stopped and the process of discharging the battery commences to lower the voltage, the same switch puts the regulating cells back in the circuit as they are needed to keep the pressure still constant. Not only does the controller do all this without the necessity of any human intervention whatever, but the regulat-

ing cells, which do not get discharged to the same extent as the rest of the battery, are individually disconnected from the dynamo as soon as they are full. Should the fuel supply run short or the engine stop working from any cause, the dynamo is automatically disconnected and the plant shuts down. An addition to the standard equipment enables the plant to be started automatically if the demand for current exceeds any given quantity, without waiting for the battery to be discharged—a great advantage in cases in which a temporary heavy demand occurs at certain periods, as, for example, when electric ovens are employed. By this means a smaller battery than otherwise may be used, the generating set supplying the current for the ovens direct, the battery only then being called upon if the demand exceeds the full output of the engine.

The exhibits of Marshall, Sons and Co., Ltd., of Gainsborough, comprise a single cylinder steam traction

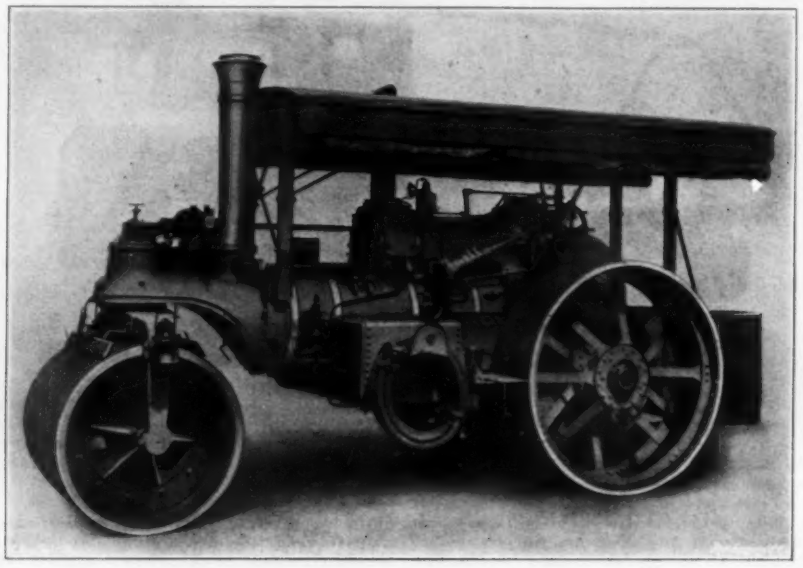


FIG. 18—8-TON UNIVERSAL STEAM ROAD ROLLER—MARSHALL

engine, a 10-ton steam road roller with piston valve gear, a portable steam engine, oil engines from 12 to 60 brake horse-power, threshing machines with all steel frames, power driven concrete mixers, and a Marshall-Universal steam road roller of 8 tons weight. This roller—of which we give an illustration in Fig. 18—has been designed to meet the modern need for a steam roller combining the operating advantages of the three-wheel and tandem types. Its rollers are adaptable to any required road camber by means of automatic and locking devices. The main axle A is made in two parts, as shown in the accompanying sketch, Fig. 19, each half being supported on horizontal trunnions B B. Their inner ends C C are carried in a box which forms the upper part of the lifting screw D. The lifting gear is operated by means of

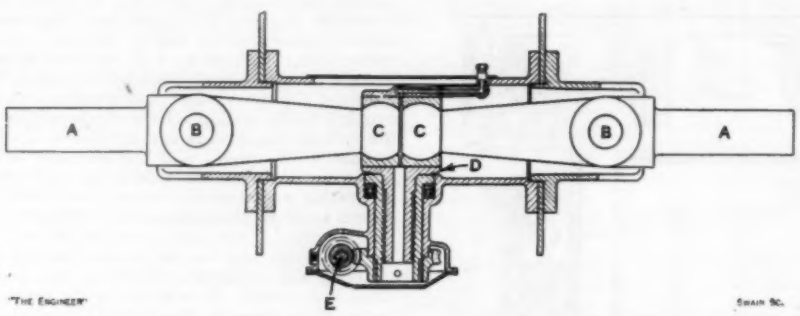


FIG. 19—MAIN AXLE OF 8-TON ROAD ROLLER—MARSHALL

a handle on the worm shaft E, so as to elevate the inner ends of the arms C.

The National Gas Engine Company, Ltd., is represented chiefly by petrol-paraffin engines, some of which are shown operating pumps and dynamos. It also shows one of its self-starting horizontal twin-cylinder heavy oil engines of 110 B.H.P. These engines have now been on the market for some considerable time, and have been specially designed for operating on the lowest grade fuel oil. They are of massive construction and the design is such that all the bearings and working parts are easy of access. The fuel pump and atomiser are very effective and the latter passes through the water jacket to the combustion chamber, the entire service of which is water-cooled. Direct action is given to the fuel pump through the medium of a lever and case-hardened steel cam which is easy of access. The fuel pump and atomiser are machined from solid steel. For starting purposes a small compressor with an air receiver is supplied with the engine. In tests made of a 66 B.H.P. standard heavy oil engine of this type by Professor Gibson and Mr. Tookey a thermal efficiency per brake horse-power of nearly 34 per cent. at full load was obtained at trials which they carried out at the makers' works. The fuel used was of a specific gravity of 0·933 at 60 deg. Fah., the net calorific value being 17,851 B.Th.U. per pound.

The vertical petrol-paraffin engine exhibited by this firm has been designed to provide a handy power unit of robust construction. It is of the vertical single-cylinder type with totally enclosed crank case and operates on a four-stroke cycle. The lubrication of the moving parts is entirely automatic and the engine is fitted with a carburetter to vaporise either petrol or paraffin without preheating the air supplies. If the engine is required to run on paraffin, all that is necessary is to start up and run it for a few minutes on petrol, after which the paraffin may be turned on.

J. and H. McLaren, Ltd., Leeds, who are among the principal makers of ploughing tackle in this country, have for some time been using petrol or paraffin engines for this class of work. They are now taking a step further by adapting the Diesel engine, and amongst their exhibits at Newport are to be seen a 60–70 B.H.P. motor windlass with a McLaren-Benz engine for cable ploughing. There is also a Diesel-engined road roller fitted with a 30–35 B.H.P. Benz engine. The exhibitors inform us that in recent trials against petrol and superheated steam the McLaren-Diesel engine compared very favourably. This firm also shows a new device for stabilising the engine power in relation to the ploughing speed. With this apparatus it is claimed that the load on the engine when hauling a cable plough is equalised. The desired result is brought about by the employment of a supercharger. For constructional reasons the diameter of a winding drum has to be limited to certain dimensions, with the result that the difference in rope speed of the first and of the last laps varies from about 30 per cent. to 35 per cent., depending on the length of the rope. In cable tackles it is necessary to allow for this difference in speed, which means that, at the start, the pulling power is about one-third below the normal output of the engine, to be certain that the engine can pull the same load when the last laps of the rope are filling the winding drum. In the McLaren-Van Dyk invention the idea is that, when starting to pull, the engine is loaded up to about 10 per cent. under normal full load with ordinary conditions, and so arranged that it is impossible to start winding with extra air. Every fresh lap on the winding drum automatically gives to the engine slightly more air. The engine power increases automatically in relation to the higher rope speed, so that in winding the last lap on the drum the engine load is kept about 10 per cent. under full load with the extra air supply.

One of the exhibits of the Wolseley Sheep Shearing Machine Company, Ltd., of Witton, Birmingham, is a portable electric shearing and lighting plant. This set comprises a "Wolseley" 2½ H.P. vertical petrol engine, water-cooled, and fitted with mechanical lubrication governor, and a slow running device. This engine is claimed to be very economical in the consumption of both fuel and lubricating oil, and to be steady when running under all load variations even as low as 250 r.p.m. The dynamo gives an output of 1 k.W. with an engine speed of 400 r.p.m., and transmission from the engine is by silent chain which gives a positive drive and quiet running. The framework, which is made of seamless steel tubing, is light and strong, and leaves no ragged corners to catch the operator's hands, while the four corner pillars are made to telescope, so that the user can reduce the height for more convenient storage or transportation. This reduction in height does not in any way interfere with the working of the engine, dynamo or shears, but when the height is reduced the machine is, of course, not so convenient for the operation of the shears, as the full height is the correct one for use when sheep shearing. When not in use for sheep shearing, the set can be used for the lighting of the house, cow sheds, stables or other farm buildings. The generator having an output up to 700 watts, it would be sufficient for 35–20 watt lamps or their equivalent when the engine is running at 400 r.p.m. The lighting would of course, be direct, as no batteries are supplied. When the set is not being used for either sheep shearing or house lighting, it may be brought into use for other farm work, such as pulping, chaff cutting, milk separating or the driving of any class of machinery within, that is to say, the horse-power of the engine. The set, which has four shearing machines, is entered for the Society's Silver Medal.

(To be continued.)

SIXTY YEARS AGO.

THE ceremony of the distribution of awards in connection with the French International Exhibition on Monday, July 1st, 1867, was a flamboyant affair. It was picturesquely reported in our issue of July 5th of that year. The exhibition building in the Champs de Mars contained insufficient unoccupied space for its staging. It was held in the Palais de l'Industrie, the scene of the earlier exhibition of 1855. For the august occasion that great building of stone, iron and glass was transformed by architects and horticulturalists into a garden of geraniums and roses, with twenty thousand well-stuffed and numbered seats rising in tiers around the central area. On a platform canopied and draped with crimson velvet, gold lace and embroidery, were placed the gilded throne and chairs of state for the Emperor Napoleon, the Empress, the Prince Imperial, the Prince of Wales, the Sultan of Turkey, the Prince of Prussia, the Prince of Orange, Prince Humbert, and other highnesses. In front of the organ space was reserved for five hundred instrumentalists—including twenty-five harpists—and seven hundred "female singers in white muslin dresses." Punctually at two o'clock to the accompaniment of a swelling roar of voices from without, the rolling of drums and the bray of trumpets, the Emperor, "the foremost man of all the world," the graceful sharer of his throne, their heir-to-be—"the boy now looking healthy and well in his black velvet tunic and knicker-bockers and scarlet stockings"—and the numerous royal and other guests made their appearance and took their seats. Then the immense orchestra, together with the seven hundred female singers in white muslin and the twenty-five harpists burst forth into a hymn especially composed for the occasion by Rossini, a hymn vaunting perhaps, in the opinion of some, too much the glories of France. The clashing of great bells and the discharge of cannon outside brought the hymn to an end. The Emperor smiled to the verge of laughter, so nearly apparently to him did the proceedings approach the ridiculous. Then the vice-president of the Imperial Commission read his report to the Emperor, from which it appeared that the jury had awarded to the exhibitors 64 grand prizes, 883 gold, 3653 silver and 6565 bronze medals and 5801 honourable mentions. The Emperor replied, extolling the greatness, prosperity and freedom of France and her love of peace. Then he passed to the presentation of the awards. When the award was announced of a medal to himself for workmen's houses and model farms, the little Prince Imperial took the medal from the hands of Marshal Vaillant and with "the lithesome grace of childhood" gave it to his father. We did not misjudge the tinsel of the ceremony for gold, but we were obviously impressed by it. It was impossible, we said, not to see in it a promise of the abolition of darkness and superstition, cruelty and self-inflicted woe among men and nations, and of an advance towards the real and lasting happiness of the human family. So much for human vision! In three years time France was lying exhausted under the heel of Prussia, the Emperor was a prisoner in the Castle of Wilhelmshöhe and the Empress a fugitive at Chislehurst. Within six years the Emperor was dead, and within twelve the little boy in black velvet tunic and scarlet stockings fell the victim of a Zulu assegai.

WHAT are known as the "Railway Returns"—the statistics of capital, receipts, expenditure and operating results—for the year 1926 have now been published, and copies, 21s. each, can be obtained from the Stationery Office.

Railway Matters.

THE cost of living figure on June 1st was 63 points above the July, 1914, level. As that is 12 points below the figure prevailing on December 1st, when the railwaymen's bonus was last adjusted, they must now lose a further 2s. Some are only 1s. 6d. or 1s. above the base rate, so simply lose that; those now receiving the base rate are unaffected.

THE train of the London and North-Eastern Railway which is to make the non-stop run between King's Cross and Newcastle is the 9.50 a.m., which will be due in the latter city at 3.20 p.m., and is therefore timed to cover the 268 miles in 5½ hours, or an average of 48.73 miles per hour. Edinburgh will still be allowed the full 8½ hours, as now. It may be noted that the train will not run on Tuesdays or Wednesdays.

A QUESTION addressed to the Under-Secretary for India on June 16th suggested that there should be one authority in India who should give systematic consideration to the railway gauge problem there. Earl Winterton, replying, said that the question was considered in relation to every scheme. The view of the Government of India was that such an authority would interfere with and possibly delay the work of improving and developing the railways.

THE retirement, mentioned in our Seven-Day Journal, of Mr. A. W. Szlumper from the position of chief engineer to the Southern Railway, has led to the promotion to that office of Mr. George Ellson, who has been the deputy chief engineer since the formation of the Southern Railway as from January 1st, 1923. In 1913, when the late Sir Percy —then Mr.—Tempest was chief engineer of the South-Eastern and Chatham, Mr. Ellson was assistant engineer, and when Sir Percy Tempest was made general manager also he became resident engineer.

THE Institution of Railway Signal Engineers has recently held its summer meeting in France. The places visited included power signalling installations at Lens, Longueau, Creil and St. Denis. Considerable interest was taken in what is known as route signalling, whereby the movement of one lever will "set up" a route, *i.e.*, either move or hold all the points concerned, and lower the signal to suit. Thus at Creil No. 2 box, where the Aster system is in operation, 421 routes are possible, but seventy-two levers, coupled to twenty-four signals and forty-five switches, do all the work.

THE Great Western Railway Company has initiated what is quite a good idea, both from the benefits to be conferred on the travelling public and from its influence on the company's own receipts. What are called "land cruises" have been introduced, which include an opening railway journey on a Monday to some centre out of London, as, for instance, to Swindon, where the company's works will be visited, and thence by rail to Stroud, and by road motor and occasionally by train, to Cheltenham, Gloucester, Hereford, the Wye Valley, Leamington, Oxford and other places, arriving back in London on a Saturday.

ON page 662 of our issue of June 17th we referred to Mr. A. C. Cookson having succeeded Mr. M. H. Deans as the stores superintendent to the Great Western Railway and mentioned that Mr. Deans was an engineer. It is now opportune to state that Mr. Cookson also is an engineer, and has had charge of new works and maintenance. Since 1920 he has been the Great Western Company's representative on a committee that has been studying the question of impact on bridges. That work is now being undertaken by the Bridge Stress Committee of the Department of Scientific and Industrial Research, on whose behalf tests and experiments have been made on numerous typical railway bridges.

THE necessities of the train service on the French State Railways have led to the execution of a smart piece of engineering. At Cabariot, near Rochefort, a new bridge is being built, and in order not to interrupt the service in any way it was decided to lift the present bridge in one single piece, and to use it to link up a temporary line while the new bridge was being built. The Pont de la Boutonne, as it is called, is 280ft. long and 29ft. wide, and weighs nearly 400 tons. After minute preparations the structure was lifted by four cranes, and was then slid along greased rails into its new place. The operation was most successfully performed, the lines crossing it coinciding exactly with the new permanent way already constructed. All was finished when the Bordeaux express passed over the bridge an hour later.

THE first of forty locomotives of an entirely new type, ordered by the Canadian National Railways, has been completed by the Canadian Locomotive Works, Kingston, Ont. It is the largest locomotive in the British Empire, and surpasses all other engines in weight, length and hauling capacity. Previous Canadian engines have been designed after the American type with some modifications. In designing the new 6100 type, Canadian engineers have evolved an entirely new type of steam engine, and it has been named the Northern. The new locomotive with tender weighs 326 tons, and in length has an overall measurement of 94ft. 6in. Of the forty engines of this type, of which twenty are to be built by the Canadian Locomotive Works, Kingston, and twenty by the Montreal Locomotive Works, twenty will be put in service on the fast through trains between Montreal and Chicago.

IT is now announced that Mr. T. E. Heywood, at present district mechanical engineer, Gorton, London and North-Eastern Railway, will go to Cowlairs on August 1st to succeed Mr. Thom, who, as related on page 693 of THE ENGINEER of June 24th, replaces Mr. F. Wintour as mechanical engineer, Doncaster. On the same date the following further appointments will be effective:—Mr. R. A. Copperthwaite, locomotive workshops manager, North-Eastern area, to be assistant mechanical engineer, Darlington (apparently a new position); Mr. E. Thompson, carriage and wagon works manager, North-Eastern area, to be assistant mechanical engineer, Stratford: Mr. F. W. Carr, carriage and wagon works manager, York, to be works manager, locomotive shops, Darlington; Mr. A. H. Peppercorn, carriage and works manager, Doncaster, to succeed Mr. Carr, and Mr. W. H. Brown, now wagon works manager at Doncaster, to be carriage works manager also.

Notes and Memoranda.

IT is claimed for a centrifugal pump recently installed in Detroit, that it has an efficiency, for pump and motor combined, of 84·7 per cent. It has a capacity of 50 million gallons a day and works against a head of 170ft.

IN the course of a lecture on flood prevention to members of the Town Planning Association of Queensland, Mr. Inigo Jones suggested a water conservation scheme by the erection of a dam across the Upper Stanley River, near Peachester, the water to be conveyed to Brisbane, *viâ* Caboolture, by gravitation. The dam would have to be 115ft. high by 3000ft. long.

ANY Dutch member of the Netherlands Wireless Telegraphy Society who, "by invention or any new method contributes in the widest sense of the word towards the advancement of the science and technique of wireless," may be the recipient of a newly instituted annual prize which has been provided for by a donation of 100,000 Dutch florins—about £8300—by the President of the Society.

IN his observations on the explosion of a steam pipe, which was caused by water hammer, the Engineer Surveyor-in-Chief, Board of Trade, says that if it is anticipated that all the boilers connected with a main range may not be in use at one time, it is recommended that additional stop valves should be fitted at the junctions of the branch pipes with the main range, thereby isolating the pipes in which water can accumulate.

DURING the nine months to March 31st last the aggregate weight of goods brought into the Port of Sydney was 3,628,821 tons, or 318,930 tons in excess of the volume for the corresponding term of 1925–26. Goods imported from oversea increased by 28,988 tons to 1,414,341 tons; interstate imports expanded by 142,069 tons to 752,992 tons; whole goods from other ports in New South Wales moved up by 147,873 tons to 1,461,488 tons. In value, overseas imports rose from £47,068,745 to £51,317,164, and interstate imports from £16,225,771 to £20,311,878.

THE United States, by far the largest producer of iron and steel, depends almost wholly upon foreign countries for the manganese which is an essential in the industry, according to the United States Bureau of Mines, Department of Commerce. In 1925, the last year for which figures are available, 890,428 tons of high-grade manganese ore were used in the United States, 615,000 tons being imported during the year. The United States uses approximately 35 per cent. of the world's annual output of high-grade manganese ores, but its contribution to that output is only 4 per cent. More than 92 per cent. of the manganese now utilised goes into the manufacture of steel.

THE method of analysis adopted by the United States Bureau of Mines for its surveys of typical crude petroleums is a modification of the Hempel distillation method. In brief, the method involves the distillation of a sample of crude oil under carefully controlled conditions that can be duplicated readily, and the subsequent examination of the series of successive fractions thus obtained. In addition, the gravity, colour, viscosity, pour point and the sulphur content of the crude oil itself are determined. Detailed information in regard to this subject is contained in a report on "The Interpretation of Crude-Oil Analyses," recently issued by the Department of Commerce.

ACCORDING to the *Industrial Australian*, preparations are well in hand for a commencement on the work of erecting the main arch of the Sydney Harbour Bridge, which will proceed simultaneously from both sides of the harbour. While the arch is in course of construction huge steel cables will bear the weight of the steel work over the harbour. Each half of the arch will be temporarily supported by cables, each 8in. in circumference. A large tunnel has been constructed at Dawes Point, and in it will be placed the cables, each of which will be equal to bearing a strain of 1600 tons. The cables will pass through the tunnel—which will be 120ft. below the surface of the ground—and round the end post of the arch, and when the two halves of the arch meet the arch will support itself. The temporary cables will then be removed.

IN the House of Commons Mr. Grotrian recently asked the Postmaster-General whether, in view of the advantage to the fishing fleet, it was permissible for private individuals to establish a wireless telephone service with the trawlers and other vessels with which they were connected; and whether he would define the general attitude of the Post Office towards initiative of this nature which was not met by any existing State service. Sir Wm. Mitchell-Thomson replied that in view of the risk of interference it was not practicable to permit the establishment of private wireless stations for communication with ships at sea. Vessels fitted with wireless telegraph apparatus could send and receive messages through any of the Post Office coast stations, and in order to meet the needs of a number of trawlers which had recently been fitted with wireless telephone apparatus, arrangements were being made to equip the new coast station now in course of construction at Mablethorpe with suitable apparatus for the exchange of messages with those vessels by wireless telephony.

AN unusual form of boiler accident is described in a recent official report. The accident was caused by the breaking of a stay connecting the furnace crown with a stiffening ring. The stiffening rings were of channel section, 3in. by 3½in. by 3in., made out of steel plate ½in. thick. These were placed partly around the circumference of the furnace, leaving a clearance space of about 2in. The supporting stays, which were of steel, 1¼in. diameter, screwed with a fine thread, were spaced about 7in. to 8in. apart and put in from the fire side, screwed through the furnace, and some of them through the stiffening rings also. A cap washer and nut were fitted to each stay and the ends of the stays were riveted over on the fire side. The stiffening rings, situated about 2in. away from the furnace and surrounded by boiler water, would remain at a comparatively uniform temperature, whilst the stays with the ends screwed through the furnace would be frequently subjected to severe changes of temperature, and would therefore suffer severe working stresses, which eventually caused a number of them to break off short. Some of the stays which were found broken, but remained in the furnace, were overlapped as much as ½in.

Miscellanea.

THE output of pig iron in the United States last year was 38,181,055 tons, while the iron ore mined amounted to 67,623,000 tons.

THE Australian General Electric Company has decided to erect a factory at Hamilton, near Newcastle, N.S.W., where 100 men will be employed.

IT has been decided by the new Victoria Labour Ministry to give immediate attention to the construction of a bridge over the Yarra at Spencer-street.

A NEW water-borne sewage scheme has been drawn up for the Council of Gwelo, South Africa, by Mr. F. Walton Jameson, which will cost approximately £27,500.

THE imports of machinery into Malaya during the first quarter of 1927 amounted to 53,788 pieces, valued at £809,405, as compared with 52,845 pieces, valued at £597,123 during the corresponding period of 1926.

IT is proposed to put up a newsprint pulp mill on the Nelson River, Manitoba, with a capacity of 400 tons a day, while another mill on the Nimpkisk River, British Columbia, of which the ultimate capacity has not yet been decided, is to cost from 10,000,000 to 15,000,000 dollars.

THE Council of Public Works at Santiago, Chile, has approved a project for damming the Rio Laguna in the Province of Coquimbo. The construction, which will occupy six years and cost about 5,000,000 pesos, will bring 12,000 hectares of good agricultural land under irrigation.

IN connection with the water supply of Wangaratta, Victoria, Mr. B. A. Smith has reported that boring has not revealed a plentiful enough supply, the requirement being 60,000 gallons per hour. In lieu of further boring, he recommends pumping water from the Ovens River. The King River water, he states, is not so pure.

THE new railway station which is to be constructed at Johannesburg is to occupy an area measuring 530ft. by 210ft., extending from Joubert-street on the west to Hoek-street on the east, and from Noord-street on the north to De Villiers-street on the south. There will also be twice as many platforms and tracks as exist to-day. The building will consist of four storeys and basement, with an attic.

THE Government of India, with the concurrence of the Local Government, has come to the conclusion that the construction of the proposed bridge over the Irrawaddy at Sagaing should be taken in hand as quickly as possible. The bridge is estimated to cost Rs. 155 lakhs. The Burma Government has agreed to pay to the Government of India Rs. 18½ lakhs as its share of the first cost of the bridge, and in addition an annual contribution from the date of opening of the bridge of Rs. 1,00,000 for a period of ten years.

THE Brazilian State Government will, it is announced, shortly invite tenders for a steel bridge over the Rio Doce, at Colatina. The Doce, which is also known as the Chopotó and Piranga, traverses the State of Espirito Santo from north to south, and, in its course over a wide alluvial plain, thickly wooded, seeks an outlet to the sea through numerous channels, thus forming a vast delta. The new bridge will, it is thought, prove of great value to the gold and diamond-mining districts where at present only mule transport exists.

ON May 11th the Central Electricity Board published the Central Scotland Electricity scheme, 1927, in the form in which it was received from the Electricity Commissioners, and gave notice that authorised undertakers and other persons interested might make representations thereon up to June 14th. Certain representations were received, as a result of which some detailed modifications have been made in the scheme. The Board has now adopted the scheme as amended, and in accordance with the statutory provisions, it was published in its final form on July 1st.

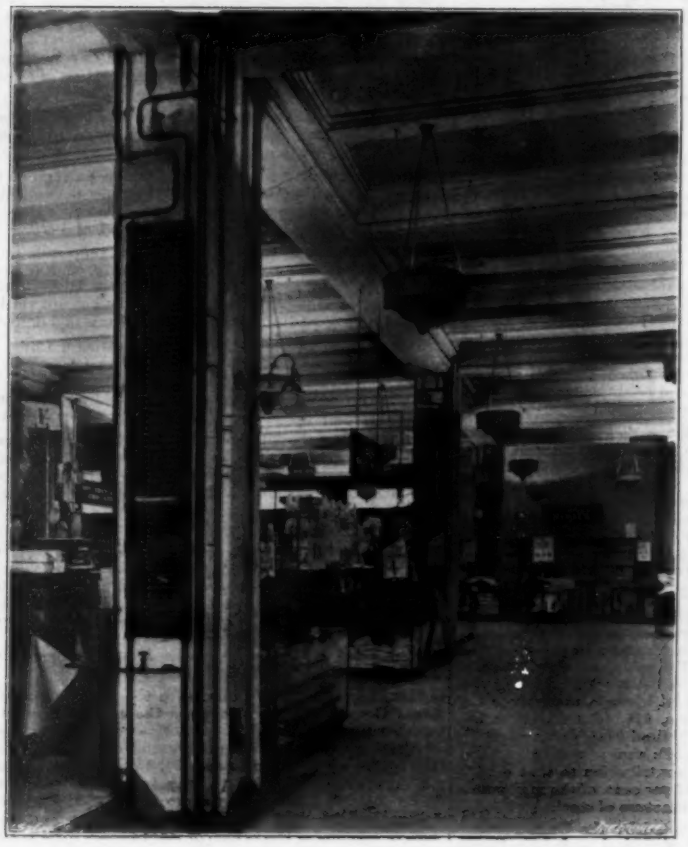
THE death of Dr. Eugene Haanel at the age of eighty-six years is announced as having taken place at Ottawa on June 26th. Dr. Haanel, who was formerly Director of the Canadian Department of Mines, had a wide reputation as a metallurgist, and his researches were an important factor in the development of the iron and steel industry. He was born in Germany, and, after some years spent in the United States, where he served in the Federal Army, he entered the service of the Canadian Department of the Interior. When the Department of Mines was created he received the appointment of Director, a position which he held until 1920, when he retired on account of ill-health. His most important work was that accomplished as chairman of the Commission appointed in 1904 to investigate the process of the electrical reduction of iron ores and steel refining carried on in Europe. He also invented the double furnace for the reduction of iron ores. He received many academic honours from Canadian and American Universities, and was the author of many valuable reports dealing with scientific subjects.

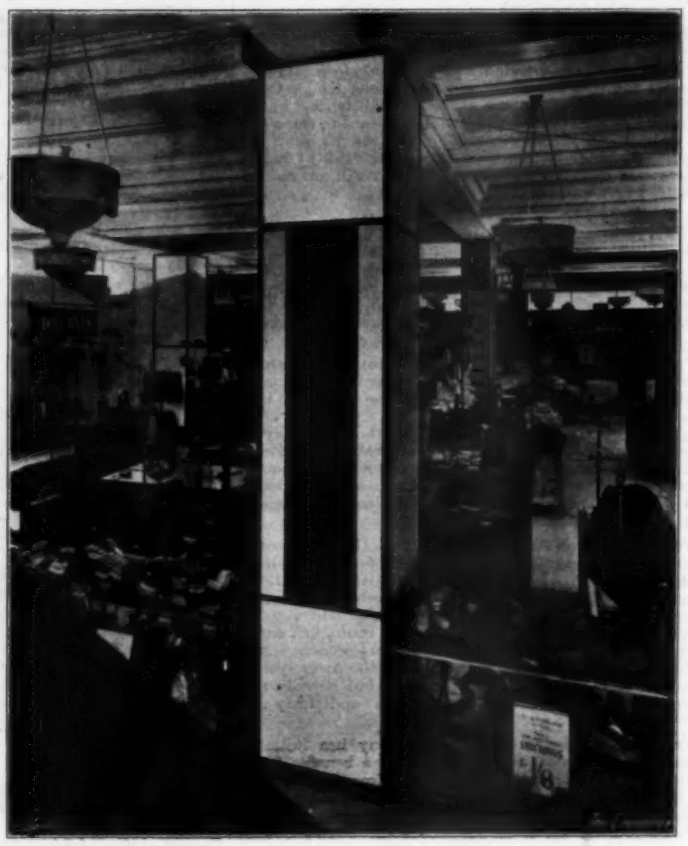
A REPORT from Detroit states that although no official announcement has been issued by the Ford Motor Company as to details of its new cars, it is understood that principal features are as follows:—The new vehicles will be four-cylinder standard gear shift cars made in four models to sell from 450 dollars for the touring car to 490 dollars for the coupé and four-door sedan, f.o.b. Detroit. In addition to these two models, there will be a roadster at 460 dollars, a cabriolet at 470 dollars and two-door sedan at 480 dollars. The standard equipment of the new cars is to comprise a self-starter, five wire wheels, a speedometer, a wind-shield wiper, a petrol gauge, an oil gauge, an ammeter, a dash light and Houdaile shock absorbers. The four-cylinder engine is rated at 34 horse-power, and is to operate at 2400 revolutions per minute. The car is, it is said, to be guaranteed to do 60 miles an hour, to run from 30 to 35 miles on a gallon of petrol, and to accelerate from five miles to 30 miles an hour in 30 seconds. The various models are to be built on a 104in. wheel base, and the painting is to be finished with pyroxlyn, which is guaranteed not to scratch. The four-wheel brakes, which are of a mechanical expanding type, were, it is stated, designed by Mr. Henry Ford himself, and embody entirely new principles of construction.

HEATING ARRANGEMENTS IN A LARGE STORES

HENRY LEA AND SON, BIRMINGHAM, ENGINEERS

(*For description see page 47*)





FIGS. 1 AND 2—STANCHION RADIATORS, UNCASED AND ENCASED

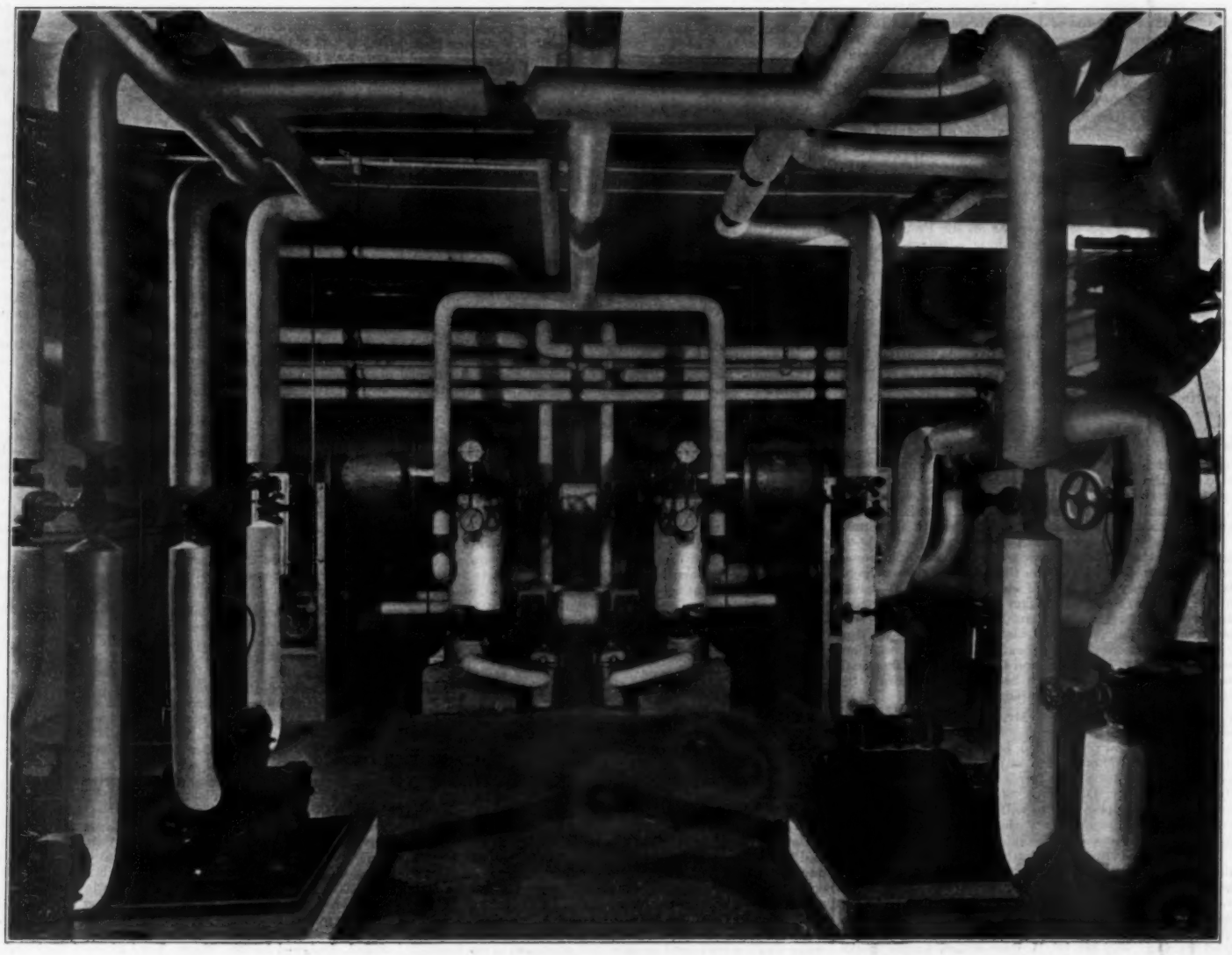


FIG. 3—INTERIOR OF CALORIFIER ROOM

The Engineer

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DEATH.

ON June 28th, in India, ALFRED HOWE COLLINSON, M. Inst. C.E., M.I.E.I., aged 62.

THE ENGINEER.

JULY 8, 1927.

Supply and Demand.

THERE can be little, if any, doubt that the boom in American industry is drawing to a close. Many engineering works are already working less than full time, some much less, and the demand for products is diminishing. In similar circumstances in this country we speak of "over-production"; in America they call it "under-consumption." There is much significance in the difference. If over-production is acknowledged as the cause of the depression, then the only thing to do, willy-nilly, is to reduce output. But, on the other hand, if under-consumption is admitted, then the course clearly is to increase the demand. The attitude of mind changes with the aspect. Think of slack trade as the result of over-production and pessimism follows: There is nothing to be done; there is too much of the product in the world; we must restrict output; we must even close down. It is not our fault, but we cannot sell if people do not wish to buy. But take the opposite view. Say, not that you are producing too much, but that you are selling too little, and fatalism is replaced by hopefulness, which is followed by exertion. Something can, after all, be done. Demand is unlimited; it only needs encouraging. Increase your propaganda, improve your salesmanship, nourish a purchasing atmosphere, make people spend and spend and spend. Even pay them more so that they will have more to spend. Keep the money in circulation anyhow, by any means, and the demand will keep pace with the supply. That has hitherto been the American attitude; in the next few months we may see it put to the test.

America and Great Britain are two very different places. The one, huge, self-supplying, self-consuming, under-populated, partially developed, greedy for the new because there is no old to displace. The other, small, dependent on the outside for both supply and consumption, over-populated, fully developed, and so full of the old that the new can enter only by the edge. Comparisons between such diversities are almost valueless; the two countries are well-nigh incomparable. We could, if we would, put the whole British Empire in the scale against the United States and then comparison *would* become possible. But until that great ideal is attained we cannot but regard Great Britain as a small unit, forced even to compete with foreign countries in its own Dominions. Whilst such differences exist, can we profit at all by consideration of the American views of supply and demand? Not much, perchance, but a little. We might perhaps think less of profits and more of turnovers. We might develop such vast selling organisations as are to be found in the United States; we might extend instalment buying; we might encourage extravagance; we might do more to create a purchasing atmosphere. The American manufacturer forces his public to want what he wants it to want. He makes the supply create the demand; he does not make the supply just meet the demand and no more. There is a great difference. It is doubtful if mass production can be profitably pursued in any other way; it must always be conducted with an eye upon future consumption, and that consumption must be estimated not upon actual needs, but upon a need which can be artificially magnified. The enormous demand for electricity in the United States has been built up by that method. The whole people has been brought to "believe in electricity"; it rejoices when some new way of employing it is invented. That attitude of mind has been encouraged and developed by the supply companies. In the great cities you may find great show-rooms in which all the applications of electricity are demonstrated, and through which the public is invited to wander as though they were museums. Even the great power stations are continually open to visitors whom guides are provided to take round. In the Hudson Avenue power station of the Brooklyn Edison Company, huge diagrams and tables of statistics are displayed, and to every machine there is attached a large card explaining its purpose. No less than six thousand visitors passed through that one station in 1926. In other cities, where the stations happen to be conveniently placed, the same practice is followed. It is not to be supposed that a very large proportion of the visitors benefit technically from the inspection; but in one and all the "belief in electricity" is increased. It is unnecessary to remind our readers that Ford has followed the same lines. At the Highland Park Works, which are practically in the city of Detroit, the power house, with its gigantic combined gas and steam engines, is on the street, and is enclosed by plate-glass windows, so that it is open all day long to the public gaze. Within is a waiting-room from which at specified hours guides lead parties of visitors through the factory. We may dismiss such efforts with a laugh, we may dub them Yankee stunts, but the fact remains that they do encourage the will-to-buy.

At the back of one's mind there may be a feeling that the world is being turned topsy-turvy by the industrialists; that a demand should not be artificially stimulated, but should grow up naturally, and then, and then only, should be met by the supply. Furthermore, one may feel that it is wrong to create a demand just in order to give employment; that it is wrong to encourage extravagance, and wrong to invite people to mortgage the future by instalment buying. One may believe—as not a few Americans already do—that the wheel is revolving too fast, and will some day burst with terrible effects. These things may be; but the fact remains that we have to take the world as we find it, and if there is no other way of running an industrial country, then we must run it on those lines, distasteful as they may be to our instincts and our upbringing. The analyst may go further and assert that whilst you may encourage the sales of motor cars, gramophones, player-pianos, radio equipment, furniture and so forth by such means, you cannot develop the heavy engineering industries in that way. That is partly true, but only partly, for every one of those industries benefits indirectly. Traffic is increased and more locomotives and bridges are needed; business enlarges and huge office buildings with steel skeletons and veritable engineering plants in their insides become necessary; printing is extended, and new machinery is demanded; manufacturing plants are enlarged and new machine tools are needed and new machines to make them. Every step in the "mechanisation" of the world is bringing all branches of engineering into unity and harmony. Each one has its effect upon the others. Few industries can flourish in solitude. Each and

every one has some secondary effect. Hence the efforts to increase the expenditure in one direction has its repercussion in other industries. Keep money in circulation and all industries will be the better. It will multiply itself if it is kept moving. That appears to be the American principle at the moment. We shall see, before very long perhaps, if it is as dangerous as many in Europe and some in the United States believe.

The Condensation of Steam.

STEAM has no more obvious property than that it condenses into water when cooled. Millions of tons of steam are made to undergo this change every day in the course of industrial operations, and ever since the time of Newcomen and Watt the efficiency with which condensation can be brought about has been one of the constant preoccupations of designers and operators of power plant. Yet beyond the bare fact that condensation does take place, how little we really know of what happens when steam is cooled! So long as the steam continues in the gaseous form, we believe it to consist of a swarm of water molecules flying about in all directions. Physicists can tell us the number of such molecules per cubic centimetre, their average velocity, the number of collisions per second they make with each other, their average distance of flight between collisions, and all sorts of other things, including even the probable way in which the molecules themselves are constituted. The pressure and temperature of the steam are both due to the velocity of its molecules, pressure representing the molecular momentum destroyed per second by collisions with the walls, and temperature being proportional to the average kinetic energy of the molecules. Condensation can be effected in three ways, all of which ultimately depend on the abstraction of heat. In the first place, we may compress it at constant temperature, a process involving the removal of the heat which would otherwise cause its temperature to increase. Under such treatment more and more of the steam would become liquid as the volume was reduced, the pressure remaining constant until the whole had turned into water. The operation is the converse of what takes place in a boiler. In this case, with the feed valve shut, the water would become less and less as the volume of steam produced continually increased, the pressure being maintained constant as before, but heat being added instead of withdrawn. If the boiler worked without ebullition, merely evaporating water at the water-steam interface, the analogy might be considered exact, as we could imagine evaporation in one case and condensation in the other taking place at the water surface, the nature of the change being determined by whether heat energy was entering or leaving the steam. The visualising of the process also seems possible. Evaporation would result from the heated water molecules jumping free from the water surface as they acquired sufficient energy to do so. Conversely, condensation would occur as steam molecules fell into the water and having lost their energy could not get free again.

Such an explanation, rough as it is, might be reasonably satisfactory if one could think that it told the whole story of condensation. But if the abstraction of heat is brought about, not by contact with a colder substance, but by the destruction of the heat itself in the production of work, the picture we have drawn no longer holds. If dry steam is allowed to expand adiabatically in a cylinder, doing work by driving a piston, part of it will condense, the quantity of water formed depending on the extent to which expansion is carried. Condensation, in this case, does not take place at a surface which is cooled by the withdrawal of heat, but throughout the whole body of the steam, the freshly formed water appearing as a cloud of uniform density. The molecules collect in numbers sufficient to form visible water droplets upon such particles of dust or electrified particles as may be present. In the absence of such nuclei, condensation is retarded, but with sufficient expansion it will eventually take place, probably around accidental aggregations of molecules as nuclei. If, instead of steam, some non-condensable or rather some highly superheated gas, such as air, had done work by adiabatic expansion in the cylinder, there would have been no formation of liquid. The work would have been produced at the expense of a general slowing down of the molecules. The steam molecules, however, separate themselves into two parts, a certain proportion clinging together to form droplets with little or no velocity and the remainder continuing to fly about with an average velocity less than before expansion took place. The water which has been formed contains vastly less energy than that previously contained by the molecules of steam which it represents, and it seems reasonable to suppose that this excess energy has been disposed of by radiation from the suspended droplets. If this supposition is justified it remains to be seen what eventually becomes of the radiant energy. In so far as it is not absorbed and converted into heat at the walls of the containing vessel, it must finally serve to increase the velocity of the remaining free molecules, for there is nothing else for it to do. The mechanism of radiation is too little understood for the action to be very clearly followed, but if radiation is involved in the process of condensation a new point of view of the latter phenomenon is opened up. The question is one rather for physicists than for practical engineers to determine, although the latter may have more than an academic interest in the subject. The knowledge that gases consist of a swarm of free molecules has created a desire to explain all their characteristics by the mechanical action of the molecules upon each other or upon the walls of the vessel containing them. Condensation, however it may be brought about, is merely an aggregation of molecules. The cause of it is always an abstraction of energy, and to know exactly how each individual molecule gives up its energy is to penetrate the secret upon which the rational construction of condensing plant depends. In an ordinary surface condenser there may be, radiation effects between the mass of uncondensed steam and the cold tube surfaces. Water vapour is known to be an active radiating agent; indeed, when radiant heat passes from a burning gas to a colder body, the molecules of water and carbon dioxide are the principal sources of radiation, the oxygen, nitrogen and other practically "perfect" gases counting for almost nothing in this respect. If radiation does play a part in surface condensers, water droplets may be formed in the body of the steam, as when the latter is cooled by adiabatic expansion. If, on the other hand, radiation is entirely negligible, actual contact of the steam molecules with some cold surface would seem to be necessary to bring about condensation. On the former hypothesis, the action of a surface condenser would be improved by giving the tubes some kind of coating, which, while not interfering sensibly with the transfer of heat by conduction, would present a much more efficient radiating surface than a smooth metallic tube. Other speculations might be made, and, in fact, the whole subject must remain speculative until a theory of condensation is linked up to the kinetic theory of gases and placed upon an equally sound footing.

That there is much improvement possible in condensing apparatus can hardly be doubted. There are people to-day claiming to be able to reduce the surface generally considered necessary for a given duty by 50 per cent. by some new rearrangement of the tubes, and the fact that there are other people who accept such statements shows that design is not regarded by all as having reached finality. Those, on the other hand, who claim that every possible principle of tube arrangement has been tried already, and that there is little or nothing more to be done with the surface condenser, may be reminded that throughout the history of engineering, the degree by which an article approached perfection has always been a measure of the shortness of time before it has been superseded by something entirely different.

Institution of Mechanical Engineers.

BIRMINGHAM MEETING VISITS.

THE large number of members and their friends attending the Summer Meeting of the Institution of Mechanical Engineers in Birmingham last week found a very extensive programme of visits prepared for their instruction and entertainment. It is impossible for us to deal at all fully with each of the works inspected. Space prevents us from doing more than giving the following notes on the engineering establishments to which organised visits were paid.

On the afternoon of Tuesday, June 28th, a popular excursion was that arranged to the works of the Dunlop Rubber Company at Erdington. This factory, recently erected, employs 12,000 workers, and except for the production of its raw material is almost entirely self-contained. It includes a gigantic eight-storey building with a floor area of 600,000 square feet, which is believed to be the largest building in the world used purely for storage purposes.

On Wednesday, June 29th, a party limited to a hundred paid a whole-day visit to Wolverhampton. The principal functions consisted of a visit to the works of John Thompson Water-Tube Boilers, luncheon at the invitation of that firm, and a garden party at the house of Major and Mrs. S. J. Thompson. Messrs. Thompson's business was established at Bilston in 1840, and was removed to Wolverhampton in 1870. It now gives employment to about 2000 workpeople, and is devoted to the manufacture of water-tube and other designs of boiler. An interesting process employed at the works is that used in making the flues of dish-ended Lancashire boilers. These flues are made of one or more corrugated sections, which are heated by water gas and welded by hydraulic roller machines.

In addition to Messrs. Thompson's works, the party visited the establishments of the Sunbeam Motor Car Company, the Star Engineering Company, the Electric Construction Company, the Rees Roturbo Manufacturing Company, the Clyno Engineering Company, Alfred Hickman, and the Patent Shaft and Axletree Company.

The first Sunbeam car was built in 1899 by John Marston and the present company was formed in 1904. The works cover an area of over 60 acres, and, in addition to the production of motor cars, are engaged on the manufacture of aircraft engines and engines for racing motor boats. It is the policy of the company to avoid any suggestion of mass production methods.

The Star Engineering Company, founded in 1898 as the Star Motor Company, claims to be one of the pioneers of the British motor industry. Chief interest at the works was directed to the machine shop. The selection of suitable tools for each job has led to the attainment of an excellent production from a comparatively small shop. Among the machine tools installed there were to be noted a large battery of Fellows gear shapers, several Lees-Bradner and Barber and Colman hobbers, a number of Lapointe broaching machines, and an extensive range of grinding machines.

The Electric Construction Company formerly bore the name Elwell-Parker, and was established forty-five years ago. The works are self-contained, and manufacture practically everything connected with an electrical machine. The main factory, covering 200,000 square feet, is entirely under one roof, and on one floor. In a separate department, generator and motor control gear is manufactured.

The Rees Roturbo Manufacturing Company continues the business founded by Thomas Parker in 1894, and is chiefly concerned with the production of direct-current dynamos and motors and single and multi-stage pumps. The firm's pumps are used for pumping many kinds of liquids, such as sewage, chemical liquids, sugar juice, syrups and oils. Other manufactures include auxiliary steam turbines for process steam, rotary jet condensers and air pumps.

The Clyno Engineering Company about eighteen months ago erected new works at Bushbury for the manufacture of its design of motor car. The machine shops for the present remain at the original Pelham-street works, and are engaged upon machining parts for the complete chassis, with the exception of the engine. At the Bushbury establishment the component parts and chassis are assembled on conveyors. Here also the bodies are mounted and the cars finished complete.

Alfred Hickman's Staffordshire steel and ingot iron works at Bilston were established in 1866. They are now operated as a branch of Stewarts and Lloyds. The works cover an area of about 25 acres, and are equipped with five blast-furnaces, two mixers, three Bessemer converters and four open-hearth Siemens basic steel furnaces. The rolling plant comprises cogging mills, bar mills and a 12in. Morgan continuous strip mill. The works can produce per week about 4500 tons of pig iron, 3500 tons of Siemens-Martin ingots, and 3500 tons of Bessemer ingots.

The Patent Shaft and Axletree Company's works at Wednesbury are associated with Messrs. Vickers, through the parent company, the Metropolitan Carriage Wagon and Finance Co. The firm's title is derived from the fact that at one time it was the sole manufacturer of the original wrought-iron faggotted axle for railway vehicles. To-day its manufactures are of a very varied kind, including, in addition, railway wheels and axles, open-hearth steel in all forms and sections, bridges and other structural work, turntables, switches and crossings, pressed steel bodies, underframes and bogies, and rivets. The works have an annual capacity of 125,000 to 150,000 tons. The company's estate covers an area of about 1000 acres.

Those of the members and their friends who remained in Birmingham on Wednesday, June 29th, had an opportunity during the morning of visiting the works of W. and T. Avery, Belliss and Morcom, The Birmingham Small Arms Company, B.S.A. Tools, Elliott's Metal Company, Kynochs, and Joseph Lucas.

W. and T. Avery's Soho Foundry, Smethwick, is historic as the scene of James Watt's early labours, and the production in partnership with Matthew Boulton of his first steam engine. The works are now devoted to the manufacture of weighing, counting and testing machines, but still receive orders for the repair of some of the old types of engine. In 1909 an engine built in 1864 was repaired, new wheels being cast from the old patterns. Many of Watt's original workshops remain, and are still occupied, and some of Boulton and Watt's original machinery

still exists. There is, for example, a wall planer supposed to be the first ever built, and alongside it there is a screw whichrhas been in readiness for nearly forty years to replace the screw at present in the machine. The old coining mint is now used as a smithy, but still possesses its arched windows barricaded by iron bars to prevent the intrusion of plunderers. Within the grounds there stands the first gasholder ever constructed, from which pipes were laid to William Murdoch's cottage. Among the valued possessions of Messrs. Avery are a 24in. straight edge, which has been in use for nearly a century, and an old drilling machine with wooden teeth.

Belliss and Morcom's works were established by Mr. G. E. Belliss in 1852. In 1884 Mr. A. Morcom joined the firm. The works are now in two sections about 300 yards apart, and normally employ about 1600 men. Of particular interest to the visitors was "No. 1" self-lubricating engine, which is now disused after a life of twenty-nine years. This engine was the first designed to work with forced lubrication, and was produced in 1890, the date of the introduction of the firm's original patent. The firm has constructed nearly 8000 steam engines of its quick-revolution, forced-lubrication type, representing a total of 2,300,000 horse-power. To-day it is engaged in the manufacture of steam engines, compressors, oil engines, steam turbines, condensing plant and paraffin engines.

The works of the Birmingham Small Arms Company were established in 1861 for the manufacture of military rifles. To-day the manufacture of guns is of relatively minor importance, the character of the firm's productions having greatly changed as a result of the absorption of other businesses. The company claims that it is now the largest manufacturer of motor cycles in the world. Of the three sections of its Small Heath factory the East section was originally erected for the production of guns. The Middle Factory was largely built during the development of the cycle industry. The West Factory is a war-time erection. The East Factory still contains the gun machine shops, the barrel mill for boring and rifling work, and the browning plant for colouring gun parts. The equipment is now, however, also used for boring cycle hubs, motor car rear axle tubes, and motor cycle components. The wood-working department originally designed for the production of rifle stocks, but is to-day largely occupied on the manufacture of side-car bodies and wireless receiver cabinets. The Middle Factory contains shops devoted to the finishing of rough forgings, and to the assembly of rifles and guns, cycles and motor cycles. It also includes a polishing and plating department, a repair section, a rifle range, and an experimental department. The West Factory contains the principal machine shops, an enamelling section, a chain assembly department, a press shop with a weekly capacity of over 1¼ million components, and brazing and frame assembly shops.

The works now occupied by B.S.A. Tools were begun in 1906 by the parent company, and were used for the manufacture of B.S.A. cars, until this work was handed over to the Daimler Company in 1911. Subsequently they were used for the production of jigs and tools required in the manufacture of gun and rifle components, cycles, motor cycles and sporting rifles. The B.S.A. Tools Company was formed in 1919, and is engaged on the production of various classes of machine tools and small tools and gauges. Most of the work is carried out on special machinery designed and built in the factory itself. Included in the equipment of the factory is plant sufficient for a weekly production of 10,000 taps and dies, 20,000 drills and 2000 cutters and reamers.

Elliott's Metal Company's works at Selly Oak are entirely given up to the manufacture of copper and brass plates, sheets and wire. The chief products of the rolling mill are copper plates for locomotive fireboxes. Copper wire for telegraphs, telephones, cables and all electrical purposes, and copper tape for lightning conductors; thin brass and copper sheets and condenser plates are also included in the firm's productions.

The works of Messrs. Kynoch at Witton owe their origin to the interest which Mr. George Kynoch in early manhood acquired in the percussion cap business of Pursall, Phillips and Son, Birmingham. In 1861 Mr. Kynoch established himself at Witton with one or two sheds and half a-dozen workers. To-day the works cover 200 acres and employ over 3000 people. In 1918 the firm was amalgamated with others under the name Nobel Industries, and in 1926 that organisation in turn became merged in Imperial Chemical Industries. The firm now manufactures non-ferrous metals, military and naval ammunition, and sporting ammunition. In addition, it undertakes a considerable volume of printing work for outside firms.

Joseph Lucas's works were established in 1870 for the purpose of making hand lamps and lanterns and a special type of ship's lamp invented by the founder. Subsequently, attention was turned to bicycle lamps, and later to magneto and self-starter and lighting equipment for motor vehicles. A striking feature of the works is the extent to which the machined parts are assembled and tested, boxed and dispatched with mechanical assistance. Over 7000 workpeople are employed.

For the afternoon on Wednesday, June 29th, three alternative visits were arranged. One party visited Halesowen for the purpose of inspecting the Haywood Forge of Walter Somers. After luncheon, provided by the firm, the visitors were shown over the company's forges and machine shops. The forge was founded in 1866 by the late Mr. Walter Somers, and now covers an area of over 15 acres. The older section is equipped with twelve steam hammers of from 10 cwt. to 12 tons. In the new forge there are hydraulic presses ranging from 600 to 3600 tons. Electric overhead travelling cranes serve the presses and enable forgings up to 100 tons in weight to be handled. The machine shops include equipment for dealing with the heaviest forgings produced, and with shafts up to 120ft. in length.

A considerable party chose the General Electric Company's Witton works for their visit. After luncheon, provided by the firm, the party in sections was taken round the numerous and extensive shops constituting the firm's works. The departments inspected included the main engineering works, the standard motor works, the small motor and fan works, the transformer works, the switch gear works, the moulded insulation works, the development and testing departments, and the mica shop. Perhaps the most striking general fact revealed by the inspection was that electrical engineering is very largely a matter of mechanical engineering, and where it is not, it is to a very great extent a matter of numerous and varied manufacturing processes which are not essentially or exclusively electrical in their nature. In illustration of these remarks, it may be said that in the main engineering works devoted to the construction of heavy electrical machinery, the visitors saw at work a boring mill of 72 tons total weight, capable of accommodating a casting 12ft. 6in. in diameter, and a lathe for turning solid steel rotor forgings capable of accommodating a length of 26ft. between centres and turning diameters up to 56in. Again, in the mica shop the visitors saw an extensive department devoted solely to the building up of small, thin mica laminæ into sheets with the aid of varnish for the purpose of insulating various parts of electrical machinery. In the moulded insulation department the processes being carried out were applicable merely by a change of mould to the production of many kinds of commercial articles having no connection with electrical engineering. The Witton site extends to 120 acres, of which over 35 are occupied by buildings. It is of interest to note that they include a department producing carbons for searchlights and kinematograph projectors. These carbon works are stated to be the only works of their kind in the British Empire.

The works of the Austin Motor Car are situated at Longbridge, which is reached by the wonderful new highway from Birmingham. Here the adoption of the mass production of motor cars has been carried a good way, and visitors were able to see the ingenious appliances for the conveyance of parts as well as machine shops fitted with single-purpose machines. The machine lines are so arranged that finished details arrive on the erecting track in their proper sequence. Gravity conveyors from machine to machine are used, whilst a continuous overhead chain conveyor transports connecting-rods, pistons, &c. Apart from the special machining operations, the method of transporting material to the point at which it is needed, is an outstanding characteristic of the factory.

On Thursday, June 30th, the members and their friends were conveyed by special saloon train provided by the L.M.S. Railway to Derby for a whole-day visit of inspection to various works of engineering and other interest in that town. On arrival a large party proceeded to the works of the Royal Crown Derby Porcelain Company. The processes of manufacture followed at these works are almost entirely of a handicraft nature, but were none the less highly interesting to the many engineering visitors who were more accustomed to production process of a mechanical kind.

The rest of the members divided themselves between the locomotive works and the carriage and wagon works of the L.M.S. Railway. The locomotive works, or, to give them their official title, the Chief Mechanical Engineer's Department's Works, are mainly concerned with the building and repairing of the 3000 locomotives in service on the Midland Division of the railway. When fully engaged they employ 4500 workpeople. Some of the shops have been in existence since 1839. One such shop is No. 1 Round Shed, now employed on light boiler repairs. This shed, built in the year named, was the first engine shed to be constructed with a central turntable and radiating tracks. The erecting shop can accommodate seventy-two locomotives, and has a weekly output capacity of two new locomotives and twenty heavily repaired or rebuilt locomotives. A special department of the works is the chair foundry, with two cupolas. This foundry produces about 12,000 chairs a week for use on the permanent way of the Midland Division.

The railway company's carriage and wagon works were originally laid out in 1876, and have since been added to on several occasions. The most recent additions, the lifting and stamping shops, were built in 1910. The timber used in the saw mill is obtained as far as possible from Empire sources, and is finished to final size by means of stops and templates, the tolerance allowed being ± 0·002in. The wagon building shop illustrates the application of mass production methods to the manufacture of railway rolling stock. Each man is engaged on a particular job, and each operation is conducted at a fixed point, the work being moved to the man. No fitting or finishing is necessary, and all unnecessary lifting is avoided. There are ten main operations, and each takes approximately the same time. A wagon is turned out every thirty minutes. In the carriage building shop there are nineteen positions for erection, finishing and painting. The steel underframe is delivered complete on its own bogie to the shop, and in the space of twenty-two minutes it is equipped with floors, ends, quarters, partitions, roof, &c. In the carriage finishing shop the sliding doors, partition frames, photograph frames, door lights, &c., are added, after which the vehicle is passed to the carriage polishing shop, where it is stained, filled and spray-polished or spray-varnished. A full description of these interesting works appeared in our issue of October 12th, 1923.

After luncheon, provided by the railway company, the majority of the visitors inspected the works of Rolls-Royce, Ltd. These works were opened in 1907, and are now engaged on the production of two designs of motor car and three designs of aero-engines. They cover an area of nearly 27 acres, and give employment to over 4000 workpeople. The system of manufacture employed finds no room for mass production methods. The finished parts are produced with a very high degree of accuracy, the limits in a number of cases being as fine as 0·0001in. As an illustration of the care taken in the production of the cars, it may be mentioned that in a special department maintained as silent as possible, every back axle is run in position on its own chassis, and examined over a considerable period for the production of the slightest noise. Every newly designed part is strenuously tested before it is allowed to pass into production. If the part, however small, has any bearing on the reliability of the car, it is tested for a minimum of 10,000 miles at high speed over indifferent roads in France.

Others of the visitors chose to visit the works of Ley's Malleable Castings Company or those of Aiton and Co., or the Haslam Foundry and Engineering Company, while still others selected the lace works of William Fletcher and Sons or Boden and Co.

Ley's Malleable Iron Foundry was begun in 1874 by the late Sir Francis Ley. It has now a capacity in excess of 1000 tons of malleable castings per month, and is claimed to be the largest malleable iron foundry in Europe. It is equipped on mass production lines, and specialises in the manufacture of "black heart" castings to accurate limits.

Aiton and Co. specialise in the production of pipe work and accessories. The firm was established at Willesden in 1897, and removed to Derby in 1907. In its operations it makes use of welding to a very large extent.

The Union Foundry, now owned by the Haslam Foundry and Engineering Company, was established in 1824, and was acquired by the late Sir A. S. Haslam in 1868. The firm is almost exclusively engaged on the manufacture of refrigerating machinery, its reputation having been established by the perfection of the compressed air machine by the late Sir Alfred Haslam. The machines now manufactured operate on the ammonia and carbonic-anhydride system. The restrictions imposed on the use of preservatives in food have led the firm to organise a section of the works for the mass production of domestic refrigerating machines.

On Friday, July 1st, the members and visitors left Birmingham by special train for Coventry or Rugby. Those who selected Coventry had an opportunity of inspecting the works of Alfred Herbert, Ltd., at The Butts and at Edgwick. This business was established in 1889 by Mr. (now Sir) Alfred Herbert, in partnership with Mr. W. S. Hubbard, and at first carried on a mixed jobbing trade, making and repairing boilers and hiring out steam ploughs and traction engines. In these early days it also produced machines for sorting pills and several special machines for the ribbon trade. The bicycle industry next engaged its attention and at one time it was producing 3 to 4 tons of cycle mudguards per week. In 1894 the partnership was dissolved, and Mr. Herbert became sole governing director of the new firm of Alfred Herbert, Ltd. Although the firm is known to-day all over the world for its machine tools, it still retains something of the heterogeneity of manufactures which characterised its beginnings. In addition to various types of gauging machines its products include photographic copying apparatus, coal powdering and firing equipment and dry feeders for pigs. The Edgwick factory is now in course of being largely extended, and in a short time the original works at The Butts will be closed down and all the firm's activities concentrated at the Edgwick establishment.

Other parties during the morning of Friday, July 1st, visited the works of the Triumph Cycle Company or those of Webster and Bennett.

The Triumph Cycle Company was established in 1885 for the manufacture of pedal cycles. In 1902 it produced its first motor cycle. In 1906 its output was 500 machines. To-day its annual output is over 30,000 machines. The works produce every part of the motor cycles manufactured, and by efficient organisation has reduced the costs of production to such an extent that the price of its 4·94 horse-power standard machine is now actually 35 per cent. less

than that of the corresponding pre-war machine.

Webster and Bennett's works were established in 1887 to meet local requirements in the way of general engineering. Soon afterwards the firm began to make machine tools for the cycle industry, then in its early stages. Subsequently, it selected the vertical boring and turning mill as a particular line for specialisation, and originated the duplex table type of that machine.

Following luncheon in St. Mary's Hall, provided by Messrs. Alfred Herbert, the visitors were given the opportunity of inspecting the works of Morris Motors (Engines Branch), Armstrong-Siddeley Motors, or the ribbon and trimmings factory of J. and J. Cash.

The Engines Branch of Morris Motors employs 2500 operators, and has a fully engaged capacity of about 2000 engines and gear-boxes per week. This output, it is claimed, entitles it to rank as the largest motor car engine factory in Europe. The works are mainly of the multi-storey type, and were originally built in 1916 by Hotchkiss et Cie. for the manufacture of machine guns. Subsequently, the factory was converted for the manufacture of automobile engines, and in June, 1919, it produced its first Morris engine. On January 1st, 1923, it was purchased by Mr. Morris, and since that time its size has been increased 2½-fold and its output more than six-fold.

The works of Armstrong-Siddeley Motors are devoted to the manufacture of automobiles, air-cooled aviation engines and air-cooled engines for military purposes. They are laid out so that the movement of material from the raw to the finished state is always in the direction of the erecting shop. The works are complete with departments for the production of the chassis and for making, painting, upholstering, and trimming the bodies.

The party which visited Rugby on Friday, July 1st, refused to be depressed by the downpour which greeted it. The members went first to the works of the British Thomson-Houston Company, where they inspected not only the engineering works, but the lamp and radio valve factory. In the shops a very interesting example of heavy milling was to be seen, two slots being cut simultaneously on the opposite sides of solid forged electrical rotors. The arrangements for testing large turbines were also studied with interest, and an inspection of the very complete control gear factory was not omitted. The works are too large to be seen adequately in a morning without fatigue, but the company had erected a large marquee in the grounds to which the members were welcomed by the strains of an admirable radio receiver and "a little something" which revived them. Subsequently, they were given an excellent luncheon, with Mr. Levis, chairman of the company, in the chair. After the "King's Health," Mr. Levis welcomed the visitors in a speech in which he gave a short outline of B.T.H. history. Mr. Reavell replied in a very happy vein, and, all feeling very much better, the party drove across to the Willans works of the General Electric Company. In these works there were many interesting things to be seen, for several steam turbines and Fullagar oil engines and hydraulic turbines were in course of erection. A thing which attracted much attention is the device for finding the critical speed of rotating discs. The discs are held fast in a horizontal position by their centres. They are then set in vibration by an electric hammer and sand is scattered upon them. The sand makes Chladni figures of star form, and from the nature of the figures and the number of vibrations the safe speed can be determined.

Owing to the dropping of a line in our report of the discussion of Mr. Kerr Thomas's paper, Mr. Legros is credited with remarks made by Mr. Deakin. Mr. Deakin's speech begins in the middle of the paragraph at the words "With reference to the author's statement." In Mr. Legros's remarks the words "a roller bearing made by Watt" should read "a roller bearing made by Murdoch."

Literature.

Hydro-electric Handbook. By WILLIAM P. CREAGER, M. Am. Soc. C.E., and JOEL D. JUSTIN, M. Am. Soc. C.E., with the assistance of nine contributors. London: Chapman and Hall, Ltd. Price 40s.

THIS comprehensive volume deals with the whole series of hydro-electric problems, works, and plants, from rainfall to the last detail of transmission; a chapter on Hydraulics and one on Investigations and Reports being included. Mr. Creager is vice-president and chief engineer of the Power Corporation of New York; Mr. Justin is hydraulic engineer to the U.G.I. Contracting Company; seven of the nine contributors have the qualification M. Am. Soc. C.E., and of the remaining two, one is manager and chief engineer of the hydraulic department of his firm, and the other, Mr. Raymond A. Hopkins, M.A.I.E.E., is the author of four chapters on electrical design, plant, and transmission lines. Of the remaining thirty-one chapters, Mr. Creager contributes fifteen, Mr. Justin four, both authors jointly six, Mr. Creager and a contributor jointly one, two contributors jointly one, and four other contributors one apiece. The work may therefore be regarded as authoritative in respect of American practice in the use of the water power, the application of principles to the planning of the undertaking, the design of pressure pipes and machinery, details of plant and its management.

The volume differs from other works to which the term "handbook" is applied, in that it is not as in the case of irrigation, a summary of principles, formulæ and data relating to a subject far too large to be presented in a single volume, nor, as in many other cases, a small work providing an outline of the subject and the principal data. In contrast to both of those classes, and by providing a book of nearly 900 pages, the authors have been able fully to present all those parts of the subject proper to hydro-electric undertakings and have given similar treatment to hydraulics, tunnels, and transmission lines. Only about a quarter of the book is allotted to other parts of the subject, including rainfall, run-off, flow, flood discharges, dams, and earthen canals. This is perhaps sufficient since those subjects can be studied in other books, but for the information, especially, of mechanical and electrical engineers it is necessary to emphasise the distinction between the two kinds of treatment, the more so in that the data relating to rainfall, run-off, and flow are mainly those of the United States, while the studies relating to estimations are made in the American manner and are very limited in scope. Only two of the chapters, those on masonry and on earth dams, are described in the text as, respectively, "a rather brief synopsis" and "a general synopsis," the reader being referred to other works for fuller discussions. The chapter on earth dams contains, however, much more information than the short chapters on evaporation and on run-off, as to which no such intimation is made, nor in respect of those other chapters which need to be supplemented by studies of other books. British readers will not find in this book the data and studies necessary for estimations of run-off or storage capacities under conditions such as those of great variations in annual rainfalls, notable differences in the yearly distribution of rainfall, occasional failure of seasonal rains, or large differences in the lengths of the dry periods between seasonal rains.

The book contains nothing that is unimportant, and in every part of it there is evidence of the care taken in selecting material and of the industry of the authors and contributors in preparing lucid descriptions and useful examples of procedure, works and plant. Very good judgment has been exercised in the selection of matter for inclusion in the short discussions of dams. It may be noted that Fig. 123, a cross section of a "typical non-overflow" masonry dam, and Fig. 125, an example of the design of such a dam, are suggestive of British practice. The chapter on earthen dams is a useful study, with many figures, including ten cross sections of actual dams, all but one, the Talla dam, being American. These cross sections and the accompanying text suggest that forms long established in British and Indian practice are now more esteemed in the United States than they were some years ago. Other features of the book deserving of special notice are: a very good chapter on Hydraulic Turbines; the discussion of the Surge Tank; the two chapters on the Power-house, substructure and superstructure; and certain lists. These lists are those of items to be included or matters to be attended to, in making turbine quotations, in compiling project data, in preparing a report, in making an estimate, the last named running to nearly eight pages, from "surveys" to "working capital."

While, then, the chief feature of the work is the aggregate value of the chapters on those parts of the subject which are, in the strict sense of the term, "proper" to hydro-electric undertakings, praise must also be accorded to the authors for the way in which they have dealt, more briefly, with parts of the subject which are common to several kinds of engineering enterprises. Further, they have displayed considerable skill in making plain throughout the book the reasons for defined or alternative procedure, so that the reader is constantly aware of the aspect of the work as an enterprise involving administrative and business considerations. This has been done discreetly, so that the book is definitely one for engineers. The 494 figures include many very useful graphs and diagrams, the illustrations of plant and structures are well chosen and beautifully executed, and the tabular matter is conveniently presented. A small detail that may be worth noting is that some of the two-page graphs are inconveniently bound in the middle. Though this important work is somewhat limited in scope, in its aspect as a guide to the development of hydro-electric projects as such and generally, it presents American practice in very telling fashion, while the discussions and studies relating to the various structures are all sound and useful. Higher praise must be accorded to the chapters dealing with machinery and electricity, these being such as no engineer concerned with these matters is likely to disregard, whether he be a designer or a user.

Civil Engineering Specifications and Quantities. By C. G. COLEMAN, D.Sc. (Eng.), and G. M. FLOOD, B.Sc. (Eng.). London: Longmans, Green and Co., Ltd. Price 10s. 6d.

THIS volume shows how difficult it is for anyone who is not a practising civil engineer to write of the duties and liabilities of those who are. Really good specifications can only be written in a civil engineer's office, and really good quantities can only be taken out in a quantity surveyor's office. Practical experience, in each branch is essential. At the same time the oncoming generation of engineers must learn something about these things, and also something about the laws affecting their profession—though the latter have been very ably dealt with by Master Valentine Ball. Apart from that authority, however, there are few better qualified to teach them than the authors of this book, both of whom are connected with the Faculty of Technology, University of Manchester.

The matter of the book was originally designed to enable young civil engineers to obtain a knowledge of the fundamental facts which have to be considered in preparing specifications and quantities for constructional work, and it is for that reason, no doubt, that a great deal of the information given appears to be rather elementary. One must start at the beginning, and we do not know of any other work which gives quite the same mass of information in so concise and readable a form. The young engineer, however, must be on his guard. The authors say:—"*Removal of Materials.*—If the engineer, after inspection or testing, considers that any of the materials on the ground are unsuitable, he has the power to order them to be removed, usually within twenty-four hours. If the contractor will not do it, the engineer can, and the contractor must pay for the cost of such removal." The experienced engineer takes good care that, if space be available, any materials which he has condemned remain on the ground unused lest, being taken away, they come back again in a few days dressed in other clothes.

Dealing with quantities, in Chapter XVII. the authors say:—"It is preferable, in any case, that the assistant who is taking off the dimensions have another, or a clerk, to put them down on paper, as the alternate changing from the plan to the paper often leads to mistakes." Very few practising quantity surveyors will be found to agree with this. The eye is a better guide than the ear. Then again, in Chapter XVIII., the authors say:—"Where walls return at right angles it is safer to take the dimensions over all for each length so that the values may be always in excess. Otherwise the limits of the measurements should be temporarily marked on the plans in pencil. In many cases such excess would be unnecessarily large." Quite so; then why do it? It is just as easy to be accurate as not.

After all, these are minor points, which will no doubt be corrected in future editions. There is a great deal of valuable information in the book, and any student who purchases it and reads it will undoubtedly gain by doing so.

Irrigation, Roads and Buildings. By WILLIAM LUMISDEN STRANGE, M. Inst. C.E. London: George Routledge and Sons, Ltd. Second edition. 1927. Price 42s. net.

THE author of this interesting and well-written book, who was formerly Chief Engineer in Sind, has made only small verbal alterations and additions to the text of the first edition, which was reviewed in our issue of August 13th, 1920. New matter, covering nearly fifty pages, appears, however, in the form of an addendum.

Inside the cover the title is expanded to "Principles of Irrigation, Roads and Buildings, and of the Water Supply of Towns." Apart from the addendum about two-thirds of the book is devoted to irrigation. The significance of the author's special qualifications as a writer on this subject is suggested by some of his headings, each relating to one or to two chapters, such as "Canals in Non-alluvial Soils," "The Physics of Large Indian Rivers in Alluvial Soils," "Canals in Alluvial Soils," and "Law, Finance and Administration"—subjects which he presents very ably. Then, too, water supply, district buildings, and the roadway are usefully discussed within the intended limits and in a manner very suitable in respect of Indian and tropical conditions. The second portion under the general head of roads, namely, road works, deserves separate mention, since it deals with matters of first importance which receive little attention and in some cases are completely ignored in recent books purporting to deal with road engineering.

The new matter, most of which relates to irrigation, contains many short notes on points of present interest, as well as longer notes on subjects such as "Wells," "Seepage," "Numbers of Waterings," "High-flood Discharge," "Failures of Earthen Dams," and "Alluvial River Control." Special mention may be made of the author's account of the failure of the Waghad Dam in the Bombay Presidency, and of his study of "retired embankments," a method of river control of which more will be heard. There is also a useful summary of Leete's method of river control without embankments. Many irrigation engineers will desire to read whatever Mr. Strange has considered to be worthy of inclusion in this addendum to his well-known book.

THE Electricity Commissioners have just issued Regulations made by them under Sec. 20 of the Electricity Supply Act, which were laid before the House of Commons on June 14th and the House of Lords on June 16th.

Engineering Work in a Provincial Stores.

NOT the least important item of plant in an extensive general stores, such as those of Lewis's, Ltd., at Birmingham, Liverpool and Manchester, is that which provides a supply of heat and of hot water for the many requirements in buildings of this kind. By the courtesy of Messrs. Lewis's, we are enabled to reproduce herewith and on page 42 several photographs relating to their Manchester installations, and an isometric sketch illustrating the arrangement of the heating circuits to the stanchion radiators—a special feature referred to later.

The building extension now approaching completion and recently formally opened, more than doubles the size of the firm's Manchester establishment, and the combined floor area of the old and the new buildings is no less than 9¼ acres. The size of the old boilers and their position were unsuitable for the new and larger requirements, and consequently a complete new boiler-house has been formed in the sub-basement. It contains three 28ft. by 7ft. 6in. Galloway type Lancashire boilers, working at a pressure of 150 lb. per square inch. Johnson smoke-consuming plant has been fitted to each boiler, since the directors were anxious to do everything possible to support the efforts being made to reduce the well-known smokiness of Manchester atmosphere. These boilers supply steam at various pressures for heating, hot water supply, cooking, tailoring presses, &c., reduction from full boiler pressure being effected by means of reducing valves. The chimney, which is 138ft. high by 6ft. diameter, and is taken up within the building, consists of a steel chimney with an outer shell of brickwork. The original chimney, which served the old boilers, has been removed. Two steam headers are arranged in the boiler-house, one for the distribution of high-pressure steam, and the other for distribution of low-pressure steam—see Figs. 4 and 5. Every branch main is valved immediately after leaving its header, so as to afford simple control in case of repairs being necessary.

The heating installation is operated on the vacuum steam system, and a novel method of fixing the radiators has been adopted in the extension portion of the building. A great difficulty in connection with large stores is to find convenient positions for the ordinary two or more column radiators standing on the floor, since show cases are frequently moved from one spot to another, and isolated radiators, whilst being suitably "cloaked" one day, may be left "in the open" so to speak, the next. Moreover, there is great difficulty in finding runs for the steam and condense pipes to positions other than those at or close to a stanchion or a wall. In Messrs. Lewis's completed building there are practically no walls except those forming the outside shell, and the radiator position difficulty was therefore particularly pronounced. The building, which is approximately 254ft. by 206ft., forms a clear open series of floors, which are doubless admirable from a sales point of view, but are awkward as regards positions of radiators, &c.

The consulting engineers therefore suggested, and their clients adopted the idea, that wall type radiators should be put on two faces of each stanchion. These radiators are arranged about 3ft. above floor level, so that fixtures or counters can be placed against a stanchion, without coming into actual contact with the radiators. Every stanchion is fed by a steam and a condense pipe running vertically up it, from horizontal mains in the sub-basement. The isometric sketch given in Fig. 6 illustrates diagramatically the general lay-out of the piping. Each vertical riser is valved in the sub-basement, and, in addition, there is a valve on each steam and condense branch to each radiator. There is also, of course, a steam trap to each radiator. Thus, a whole vertical section can be closed down or individual radiators can be controlled at will. The system is found to give a well-distributed volume of heat, and, except in a few cases in which isolated radiators were essential, no pipework will be visible once the installation is completed. The engraving—Fig. 1, page 42—shows one of the stanchion radiators before it was encased, while Fig. 2 shows the same radiator after being encased. Facility will be provided in these casings for giving access to the valves and traps. When finally completed, there will be some 32,666 square feet of heating surface, including mains in the whole building, and there are some 600 radiators in all.

As regards the domestic hot water supply, high-pressure steam is lead from the high-pressure header to two Royles calorifiers, which can be seen in Fig. 3, page 42, each of which is designed to heat 1200 gallons per hour from 50 deg. to 180 deg. Fah. Two large copper storage cylinders, each of 500 gallons capacity, are interconnected, and the hot water is pumped slowly round the building by means of two Pulsometer electrically driven centrifugal pumps. Thermostat control to the calorifier steam supply is provided. There are some 400 ordinary hot water taps in the building, apart from other uses of hot water. There are no "dead-legs" in the secondary circuits, and each tap gives an immediate supply of hot water when opened.

The non-conducting lagging, as may be seen in Fig. 3, has been very efficiently carried out. The colour of the paint on all the lagging within the calorifier chamber is turquoise blue, and though perhaps, at first, such a colour sounds hardly suitable for engineering plant, the consulting engineers inform us that nothing could possibly look better than the lagging work under consideration, which is the best that has ever been done for them. The various pipes occurring about the building, will, where lagged, be painted distinctive colours, so that they may be easily identified. A first coating of magnesia, followed by an outer finish of plastic, has been adopted, as being the most efficient heat preserver.

The whole installation was designed in detail by Messrs. Henry Lea and Son, of Birmingham, who are also the engineers for Messrs. Lewis's Liverpool and Birmingham stores. The contractors for the whole of the work in Manchester, except the boilers, were G. N. Haden and Sons, Ltd., of Manchester, whilst the lagging was done by Messrs. F. Leroy and Co., also of that town. Messrs. Galloway provided and fixed the Lancashire boilers and steel stack. The heating and hot water installations have involved the use of about 10 miles run of pipes of various sizes.

Almost of equal importance to the heating and hot water supplies is the artificial lighting of a stores of this class, and it is interesting to note that Messrs. Lewis's were recommended some years ago by their consulting engineers to adopt totally indirect electric lighting in their Birmingham stores, and that they were so well satisfied with the results that the same method was adopted throughout their Liverpool stores, and later in their Manchester stores—the subject of this article. It was found that with it most coloured materials not only looked better, but that customers could match materials more readily by means of that kind of illumination. Moreover, the assistants agreed whole-heartedly that the entire absence of "glare" was very beneficial to themselves. It is only right to point out, however, that indirect lighting is not the most effective for all goods. For instance, the ironmongery department had to be lighted by means of Moonstone or opal bowls, as the necessary glitter on the goods was unobtainable with totally indirect lighting.

Anything that can be driven by electricity in all three of Messrs. Lewis's stores is so driven, including, of course, a complete service of passenger and goods lifts, a Lamson tube installation, the vacuum plant and various hair-dressing appliances. We understand that the peak load in the winter months is now about 1500 k.W., and that all the current is taken from the Manchester Corporation mains. The circuits are arranged to include on each floor a sufficient number of pilot lamps to prevent any sort of panic amongst the public in case of failure of the main supply.

The following details indicate the considerable extent of the electrical installation:—The main switchboards are 49ft. long. There are 5081 wiring points, and the total candle-power of the lamps installed is 1,270,000. The lengths of conduit and cable used were 35 and 192 miles respectively.

The whole of the wiring work was carried out by Messrs. Lewis's electrical staff, with the able assistance of Mr. A. F. Meylan, the supervising engineer, under the consulting engineers for the new electrical installation.

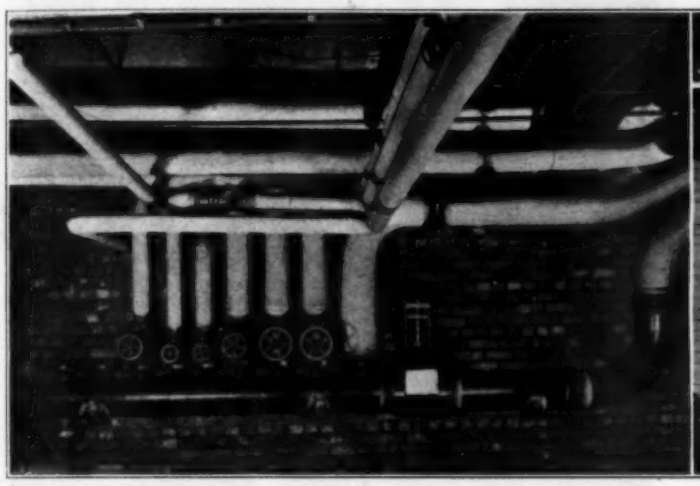


FIG. 4—HIGH-PRESSURE HEADER

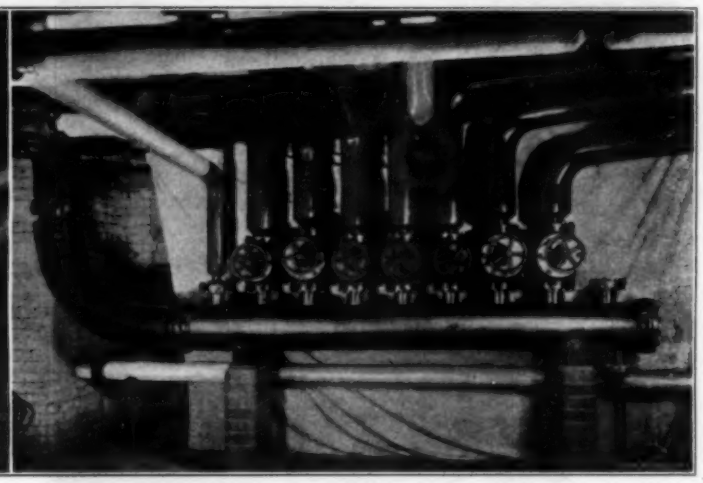


FIG. 5—LOW-PRESSURE HEADER

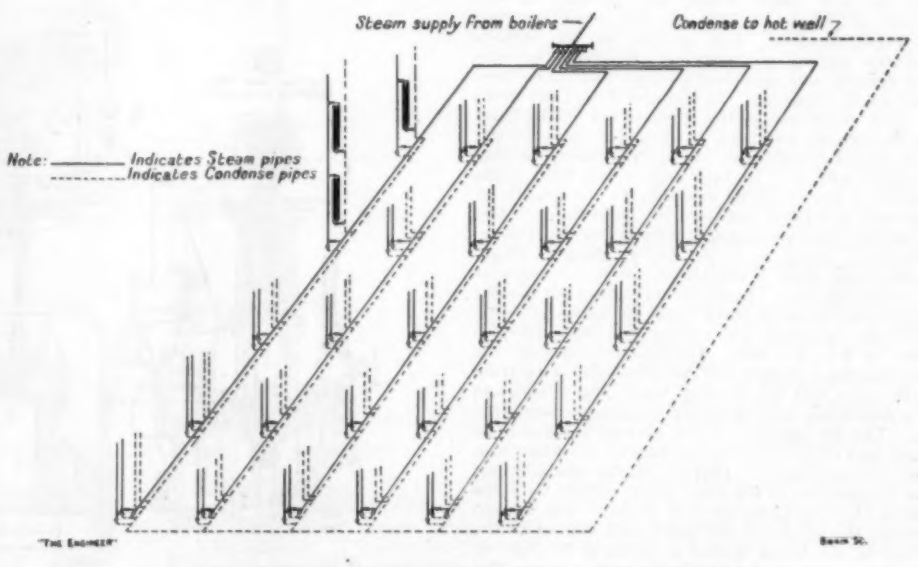


FIG. 6—ISOMETRIC SKETCH DIAGRAM OF LAY-OUT OF PIPING

FIFTEEN-ARM BRITISH GLASS BOTTLE MAKING MACHINE

DESIGNED BY MR. F. REDFERN AND MADE BY THE METROPOLITAN-VICKERS COMPANY, LTD., TRAFFORD PARK

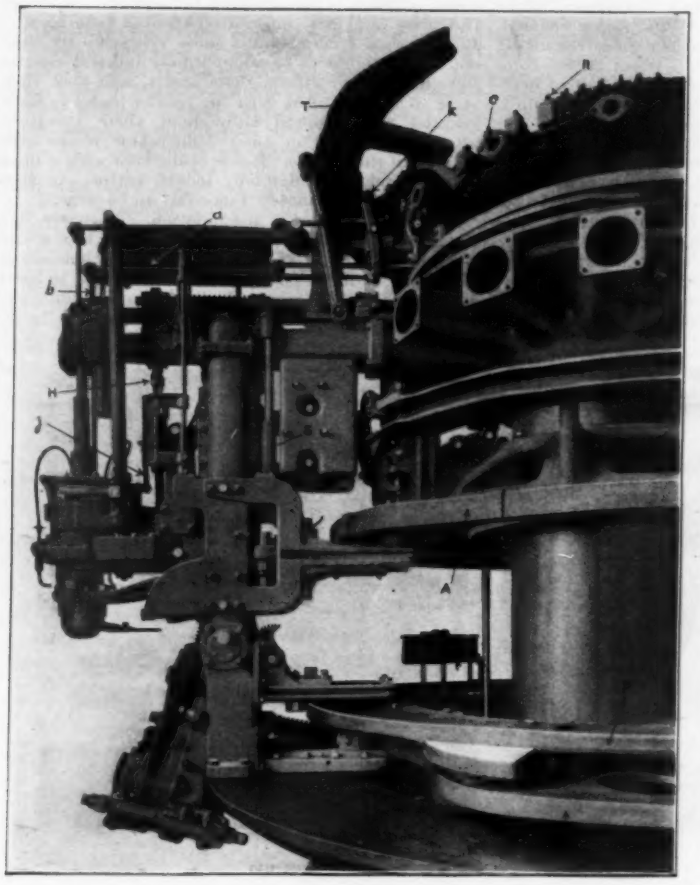


FIG. 12 (FIG. 8 REPRODUCED)—SINGLE UNIT WITH FINISHING MOULDS CLOSED

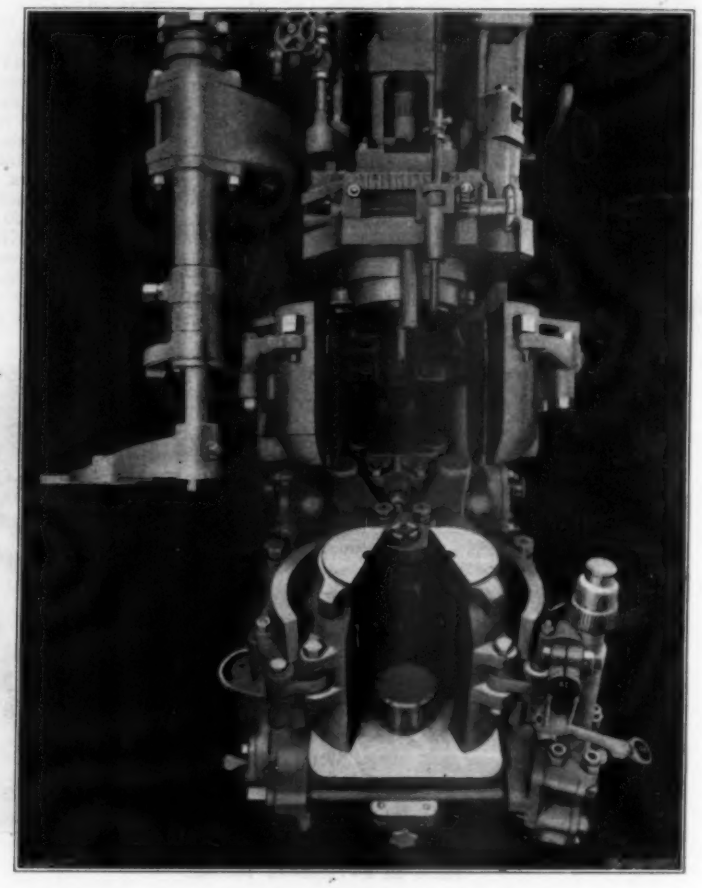


FIG. 13—GENERAL ASSEMBLY OF MOULDS

A Large Bottle-making Machine.

No. II. (*Conclusion*).*

COMING now to the fourth section of the top head—that concerned with the operation of the cut-off knife—a radical alteration has been made in the design. It will be remembered that the knife was carried at the bottom end of a vertical spindle in the first machine, with a bearing at the top fixed to the main frame and another at the bottom attached to one of the arms carrying the blank moulds. The opening of the moulds naturally caused an angular movement of the knife spindle and spherical seatings had to be provided for the bearings. In the new design the knife has been transferred to the opposite side of the head and the spindle has been fixed so far out that the blank mould has clearance to open without carrying the knife with it. In this way it has been made possible to provide fixed bearings for the spindle at both ends, bracketed out from the main frame. The new arrangement can be easily followed on the extreme right of Fig. 9 *ante*, while the way in which the blank moulds open, clear of the knife spindle, is shown at U U in Fig. 10, *ante*. In this view the finishing moulds have closed round the blank ready for blowing.

The arrangements for cooling the knife are also shown in Fig. 10, *ante*. The bracket carrying the lower bearing is hollow, for the admission of air from the U frame and the bearing bush itself is enclosed by a depending tube with air passages between the two. The air escapes at the bottom from a little mouth and blows on to the surface of the blade arm when it is stationary. There is also a controlled air blast directed on to the knife itself, so that both the bearing and the knife are well cooled. The adjustment for the height of the knife, with respect to the bottom of the blank mould is shown at W, Fig. 10 *ante*, and is very similar to the old arrangement. The adjustment is effected in steps of $^1/_{128}$in.

One of the "rectifiers" used to blow air on to the neck of the blank and thus control its elongation while it is unsupported can be seen at X, Fig. 10 *ante*, while both of them are shown in Fig. 4 *ante*. It will be noticed that the front rectifier is mounted in a transverse slide provided with numbered graduations, so that once the proper position for a definite shape of bottle has been found an exact record can be made for future reference.

We now come to that part of the head concerned with the control of the vacuum and blowing air. Here, again, some radical changes have been made, although the principle of operation remains the same.

* No. I. appeared July 1st.

The blowing head has to perform two distinct functions—first, to put the blank mould in communication with a vacuum pump for sucking up the glass, and then to supply compressed air for blowing the blank to the finished shape. The pipe connection for the vacuum is shown at *a* in Figs. 12 and 15, while the compressed air pipe is marked *b*; both of them are provided with double ball joints to allow for the rise and fall of the head. The vacuum pipes radiate from sockets *c*, Fig. 12, on the rotary crown of the machine, and each socket has a port which registers with a fixed port during that part of the revolution of the machine when it is necessary to suck up glass into the blank mould. This port opening does not, however, determine the precise time of the vacuum connection with the mould, and is adopted merely with the object of minimising the leakage which might occur if the whole of the fifteen units were always subject to the vacuum.

The timing of the vacuum can best be followed with the aid of Figs. 14 and 12. In Fig. 14 the plug cock at the lower end of the vacuum pipe is shown at *d*, and just about the time when the blank mould is dipped into the glass pot a vacuum is established in the whole of the system up to this point by the registering of the ports just mentioned, but the vacuum is held from the blank mould by the mushroom valve *e*. At the appropriate time this valve is opened, in a manner described later, and the suction takes place down the passages *ff* to the narrow clearance between the two halves of the blank mould, so that the molten glass is rapidly sucked up. Simultaneously the little

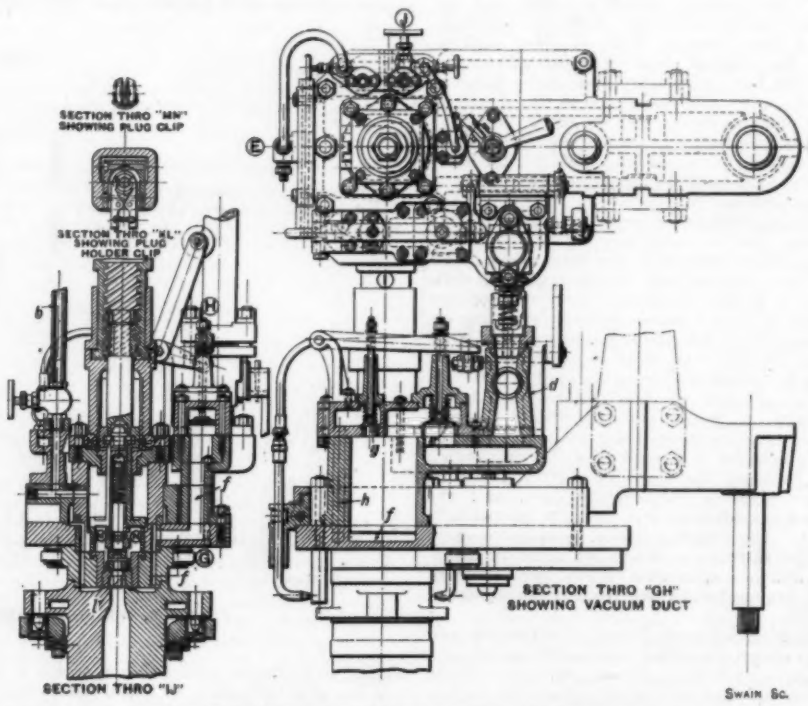

SECTION THRO "MN" SHOWING PLUG CLIP
SECTION THRO "KL" SHOWING PLUG HOLDER CLIP
SECTION THRO "GH" SHOWING VACUUM DUCT
SECTION THRO "IJ"
SWAIN Sc.

FIG. 14—ARRANGEMENT OF BLOWING HEAD AND RING MOULDS

valve *g* is opened, and establishes a connection by the passage *h* to the space surrounding the neck moulds and so ensures that the neck is well filled with glass. The opening of the valves is effected by the horizontal lever seen at the top of their stems. The free end of this lever is lifted by a bell crank, one arm of which stands vertically and can be seen at *j* in Fig. 12. Alongside this lever there is what might be described as a gate, in so far as it is a flat casting swinging on a vertical pivot. It will be seen that by swinging this gate, with the aid of the cam roller *k*, the vacuum valves can be opened, or closed, and that the rise and fall of the head will be accommodated by the bell-crank lever roller sliding up and down against the face of the gate.

Reverting now to Fig. 14, during the time while glass is being sucked up into the blank mould, the plug *l* is in the position shown and closes the top of the mould with a very fine clearance—so fine that the viscous glass cannot escape, but the suction effect of the vacuum from the valve *g* is admitted. Incidentally, the plug forms a little depression in the mouth of the bottle. When the formation of the blank has been completed, the plug is retracted by the rotation of a steep pitch screw, with the aid of a cam at the top of the central column, carrying with it a disc which has, so far, closed the space below to retain the vacuum. A little puff of compressed air is then admitted to enlarge the depression made in the mouth by the plug. This air comes down the pipe *b* through the clearance round the sides of the disc into the space above the neck ring, previously evacuated, which has now been cut off from the vacuum pump by the re-closing of the valves *e* and *g*. By this time the unit will be approaching the blowing station, the blank moulds open and the blank is left hanging in the ring moulds.

The valve for controlling the blowing air is best shown in Fig. 15 at *m*. It is operated through a system of bell-crank levers from the cam *n*. This cam is also plainly shown in Fig. 12, and is built up of a lot of little segments, each of which may comprise as many as ten layers of plate. All these segments are individually adjustable, so that the blowing air can be admitted intermittently as desired, while the ten-fold arrangement vertically allows ten, or less, different combinations being employed simultaneously for separate units. The air valve itself is so arranged that when the air supply is cut off the whole system beyond it, right down to the bottle, is open to the atmosphere and the pressure is released, so that expansion of the air cannot continue any blowing operation which it is desired to stop.

It now becomes necessary to refer to the lower section, or table, of the unit which carries the finishing moulds. The table is shown in the lower, inoperative, position in Fig. 12, and in the position for blowing in Fig. 11 *ante*, while the mechanism is illustrated by the line drawing—Fig. 15. It will be noticed, by comparison with Fig. 2, that the table of the new machine is operated on quite a different principle to that of the first machine. The balance weights have been eliminated and the table simply swings up on a substantial pivot fitted with Timken bearings. The cam for raising the table is shown at O, and pushes it up through the intervention of two powerful springs. The throw of the cam is more than sufficient for the purpose, and in the raised position the table is held, exactly horizontal, against a stop by the compression of these springs. The table naturally falls by gravity when the cam roll recedes; but to ensure against the possibility of its sticking up, which would result in its fouling the glass pot and some wreckage or other, a secondary cam is provided for positively pulling the table down as it approaches the glass pot.

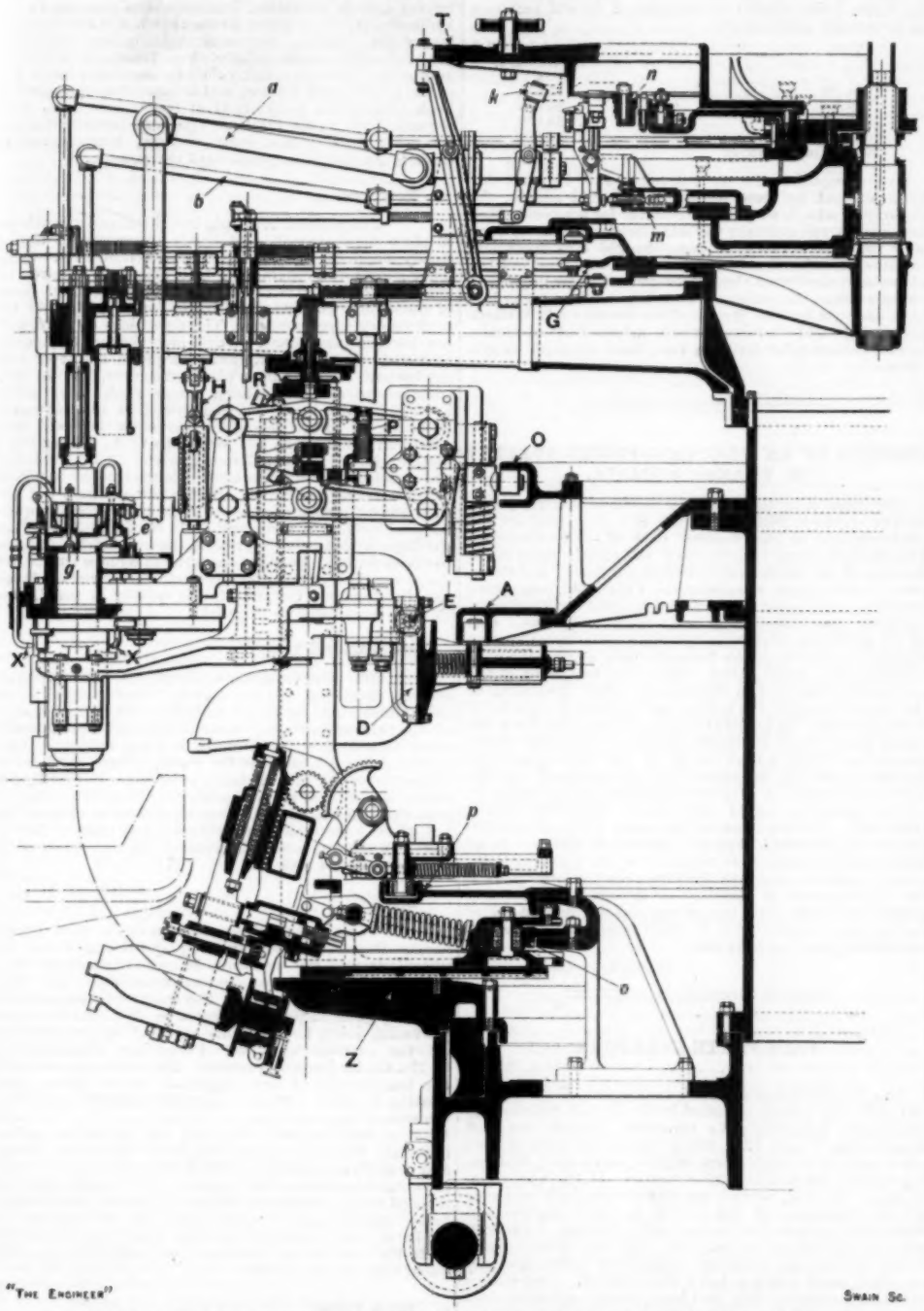


FIG. 15 (FIG. 3 REPRODUCED)—CROSS SECTION THROUGH FIFTEEN-ARM BOTTLE MAKING MACHINE

The operation of opening and closing the finishing moulds is effected by the cam *p*—Figs. 15 and 12. Directly above this cam there is a spring slide box, attached to the main frame of the unit, very similar to that used in connection with the opening and closing of the blank moulds. This slide box works a toothed quadrant which meshes with a pinion on the pivot centre of the table. This pinion, in turn, operates a rack and through a pair of toggle levers, the scissors arms carrying the finishing moulds. It will be readily appreciated that the designing of the cam for this operation was a highly complicated matter, as the movement of the mould arms is the resultant of the movements of the table about its centre and of the quadrant with respect of the pinion.

There is one other cam-controlled mechanism to which reference should be made. It is the retainer which lightly holds the finished bottle in the moulds after they have opened until the delivery stage is reached. The retainer is shown at *r* on the right of the finishing moulds in Fig. 10 *ante*. It is carried by a spindle on which there is a pinion meshing with a vertical rack. At the bottom end of this rack there is a roller which engages with a cam not very clearly shown in any of our engravings. This cam is, however, so formed that after the blowing is finished, with the mouth of the bottle exposed above the top of the finishing moulds, the retainer is swung over and lightly grips the mouth of the bottle. The finishing moulds are then free to open without the bottle dropping out, but it can be instantly released at the delivery station.

A good impression of the arrangements made for carrying and positioning the moulds can be gained from Fig. 13. The finishing moulds are pivoted on a vertical hinge post and are connected with the arms by means of short links, which allow for expansion and contraction. In the closed position, the two half moulds abut against a dowel peg, which can be seen depending from the front of the blowing head, so that they are truly centralised. The bottom mould, or block for forming the bottom of the bottle, is centralised by leaving it free until the moulds are closed around it, when it is clamped securely. The blank moulds are hung on their arms and are centralised by registering with the neck-ring moulds. It will be understood that when once the necessary adjustments have been made, the rigidity of the framework and bearings, together with the provision of definite stops for all the movements, ensures the maintenance of the true alignment of all the several parts of the moulds.

The lubrication of such a machine working under the conditions of a glass factory is naturally an important matter. The majority of the bearings are either of the Timken tapered roller or the ball type and are enclosed by dust-proof housings, so that they require very little attention; but the sliding parts must, of course, be lubricated. For this purpose oil cups are arranged in appropriate places, while there is a large lubrication box on the top of each unit, as can be plainly seen in the half-tone engravings.

We have already mentioned the fact that arrangements are provided for adjusting some of the clearances, such as that of the knife beneath the blank mould, but it is noteworthy that they can be effected while the machine is running and without the assistance of any tools, while there is room inside the machine between the revolving units and the central column for a man to stand up and attend to anything which cannot be reached from outside. In fact, although the whole machine has been very carefully designed with the object of minimising maintenance work, it is at the same time conveniently accessible. In this connection it is only proper to mention the fact that throughout the construction and design of the new machines Mr. Redfern has been assisted by Messrs. R. F. Hall and Sydney Hunt in the preparation of the detail arrangements, and that the latter designer, in especial, has been largely responsible for the ingenuity of many of the mechanisms, while Mr. Whittleman, a practical bottle maker, has made several valuable suggestions.

Taking a broad view of the machine, we feel that our personal impressions bear out, so far as our knowledge goes, the claim of the producers that it is a considerable step in advance on previous apparatus of its kind as regards design, while the workmanship of the Trafford Park Works needs no commendation. Seeing that a bottle-making machine of British origin throughout is now available, we trust that the importation of such plant will from now onwards decline.

The Proposed Remodelling of Deptford Waterworks.

SIX years and more ago the Works and Stores Committee of the Metropolitan Water Board had under consideration a scheme for remodelling the Kent district works at Deptford. Owing, however, to the exceptionally high cost of machinery then prevailing, it was deemed to be inopportune at that time to proceed with the full scheme, and all that was sanctioned by the Board was the substitution for two Boulton and Watt engines—which had been in service for 109 and 97 years respectively—of two Worthington engines that had previously been at work at the Molesey pumping station. The question of proceeding with the

full scheme was recently again brought forward, however, and was sanctioned at a meeting of the Board held on Friday, June 24th.

In a report of the Works and Stores Committee recommending the immediate carrying out of the scheme, which was presented on June 15th, it was pointed out that, having regard to the fact that some four years must elapse between the authorisation to proceed with the work and the bringing into use of the new plant, it was the Committee's opinion that the carrying out of the major portion of the scheme should be no longer delayed. It was explained that, with the exception of the two Worthington engines just referred to, the whole of the engines and pumps at the Deptford station are beyond further economical service, and that they and their boilers are of such age and condition that they would, in any case, have to be entirely renewed within the next few years. It was stated, moreover, that it was considered that a suitable time had arrived for the station to be completely remodelled in order to maintain with economy the supply of that portion of the Kent district which is served by the station; that is to say, New Cross, Greenwich Park, and Woolwich Common reservoirs, and to provide for future developments.

There are two sources of supply to the station, namely, from three wells in the chalk, and Thames water conveyed by a main 24in. in diameter from the Honor Oak reservoir. The wells are at the Twins, Cold Bath and Garden engine-houses and are about 104ft. deep. There are reservoirs of a capacity of 1·75 million gallons into which the well pumps and the 24in. main discharge, and the water is pumped to service reservoirs at various places. The engine-houses are known as follows:—The Cornish engine-house, which pumps 6 million gallons per day from tanks to Greenwich Park reservoir, top water level 158ft. O.D.; the Worthington engine-house, which pumps 3 million gallons per day from tanks to Woolwich Common reservoir, top water level 248ft. O.D. These are the engines that replaced the recently abandoned Boulton and Watt engines capable of pumping 1·75 million gallons per day; the Twins engine-house, which pumps from well to tank, and force pumps delivering to New Cross reservoir, top water level 163ft. O.D., and occasionally to Greenwich Park reservoir. These force pumps can alternatively draw from the tanks; the Cold Bath engine-house, which pumps from well to tank, the force pumps delivering a portion of the supply to Greenwich Park reservoir, top water level 158ft. O.D.; and the Garden engine-house, which pumps from well to tanks.

The well water is, when necessary, supplemented by Thames water through the 24in. main discharging into the reservoirs at ground level. The quantity of river water available for the Kent district has recently been increased by bringing into use the Walton to Honor Oak main, the supply being taken from the Honor Oak reservoir—top water level 144ft. O.D.—instead of from the Lower Nunhead reservoir—top water level 168ft. O.D.—as heretofore, although the latter reservoir is still available in case of emergency.

In view of the probability of an extended supply to the inner areas of the Kent district being required in the future from this station, thus permitting the outlying wells now partly supplying this inner area to be more largely utilised in their more immediate areas, the Committee expressed itself as being of the opinion that the most reliable and economic proposal was to install one vertical triple-expansion engine capable of pumping 7·2 million gallons per twenty-four hours from one new well connected with the three existing wells by adits, the remainder of the supply being drawn from the reservoir feed by water from the Thames supply. It is suggested that the pumps should be capable of delivering as a maximum the following quantities daily into the several zones of supply:—8·3 million gallons to the low-level district commanded by the New Cross and Greenwich Park reservoirs; 3·0 million gallons to the mid-level district commanded by the Woolwich Common, Eltham and Bromley reservoirs; and 1·1 million gallons to the high-level district commanded by the Castlewood reservoir; a total of 12·4 million gallons, 7·2 being obtained from the well and 5·2 from the Thames supply. This unit would be specially designed with four sets of pumps to permit of performing the entire work of the station, and while of high first cost would operate with maximum efficiency and minimum fuel consumption. The reserve units would consist of three steam turbines, identical in capacity, driving centrifugal pumps, each unit having two pumps arranged to pump either in parallel or in series and having a total output of either 18 million gallons to the low-level zone or 9 million gallons to the high-level zone or a variation of equivalent quantities to the high, middle, and low-level zones. The centrifugal stand-by well pump would be driven by a water turbine directly mounted on the well pumps and operated by water pressure from the delivery mains of the other units. All units should be concentrated in one engine-house so as to save labour and fuel, and the arrangement would combine the high efficiency and reliability of the reciprocating unit with the low first cost of the turbine sets.

The total estimated cost of the scheme so far as the actual remodelling of the Deptford works is concerned amounts to approximately £221,000, made up of machinery, £109,000; buildings, £76,000; and wells, headings and working out mains, £36,000. The total estimated annual charges when pumping an average total of 14·5 million gallons a day—5·5 from well, 6·3 to low level, 1·9 to mid-level zone, and ·8 to the Castlewood high-level zone—including coal, wages, stores, repairs, and capital charges, with repayment of the loan by the end of the estimated life of the plant, amount to £26,600, the working expenses being £12,800 and the capital charges £13,800. The cost of pumping 10·0 million gallons per day at this station for the year ended March 31st, 1926, was £19,672. The annual working expenses alone for the existing station when performing the same amount of work as the proposed new plant are estimated to amount to £25,800. The estimated saving in working expenses—£13,000—would therefore nearly pay the capital charges on the proposed plant of sufficient capacity to replace existing plant and also provide for future requirements. The pumps for the proposed supply of 1·1 million gallons per day to Castlewood reservoir would form an integral part of the main unit, and the cost is included in the estimates.

To provide for future developments and for the supply of Thames water to the inner portion of the district now supplied from outlying wells, allowing the supply from these wells to be confined to their more immediate areas, it will be necessary to lay the following mains:—(*a*) Main to Woolwich Common reservoir along Well Hall-road from the existing 24in. main from Eltham reservoir to Deptford and the connection of the existing 18in. Orpington to Castlewood main with the existing 30in. main from Eltham reservoir to Deptford. This is dependent on the use of the existing 24in. main from Deptford to Eltham for the supply of the Woolwich Common zone. The estimated cost is £10,250. (*b*) Main from the existing 18in. main from Orpington to Castlewood in the Foots Cray-road, where Kemnal-road and the Eltham By-pass Road join that road to Bickley reservoir. This, it is explained, would provide a jackhead for the supply from Orpington to a restricted area confined to the country district, a division valve being inserted in the 18in. main on the Castlewood side of the junction between the jackhead and the 18in. mains. The estimated cost is £20,000. The total proposed expenditure is therefore £251,250.

On the expenditure side the effect on revenue account was summarised by the Committee in the following form, the figures being subject to variation if the old buildings are eventually disposed of:—

Year.	Net additional expenditure. £
1928–29	17,000
1929–30	20,600
1930–31	24,200
1931–32	27,800
1932–33 and onwards	1,400

Having regard to the rapid development of certain districts affected by these works, there would appear, the Committee added, to be good grounds for supposing that new income will overtake the additional expenditure soon after the new works have been brought into operation. In this connection it submitted a report which set out the advantages that have already accrued at three important stations where the policy of installing modern plant had been adopted by the Board. The stations are Walton, Lea Bridge and Surbiton, where substantial economies in fuel consumption have, in fact, been obtained in this manner.

OPENING OF AN ELECTRIC POWER STATION IN TRANS-CAUCASIA.

THE opening of the Zemo-Avchalskaya electric power station on June 26th marks the first step towards the electrification of the western part of Trans-Caucasia. This electrification, it is thought, will greatly assist in the solution of the problem of developing industry and transport in the region, especially the Chiaturski manganese industry—the largest in the Soviet Union—the Tkvibulski coalfields and future paper and cement industries. One of the chief users of electrical power is the Trans-Caucasia Railway, on which on the Suramski hills section the electrification has already been begun. The first stone of the new station was laid in September, 1922. According to the original project, the station was to have a capacity of 7000 kilowatts, but in 1923 the project was revised and the initial power fixed at 12,000 kilowatts with four turbo-generators. The actual power of the turbo-generators installed proved to be greater than was planned, namely, 14,000 kilowatts. A proposed extension of the station to 28,000 kilowatts would cost about 2,000,000 roubles (£200,000). The total cost of the station will be 20,000,000 roubles (£2,000,000). The new station, in addition to its industrial importance, is expected to be a paying commercial concern, and will doubtless play a large part in the development of industry in Georgia. Its opening nearly coincided with the laying on the first stone of another large power station in Trans-Caucasia, the Rionski, which took place on June 28th.

FACE-PLATE STARTORS.

Two new British standard specifications, Nos. 246 and 247, 1927, have been published by the British Engineering Standards Association to supersede British standard specification No. 82, 1919, which covered all types of face-plate startors for both direct-current motors and alternating-current slip-ring induction motors. In the new specifications the first sections are common to both and give general definitions of the various types of startors and definitions of enclosures for face-plate startors. In British standard specification No. 246, 1927, for direct-current motor startors the standard brake horse-power size and standard rated voltages have been revised. Two classes of rating—ordinary duty and heavy duty—are recognised as standard and limits for starting current and starting period have been fixed for both these classes. The particulars to be marked on the startors and a complete list of revised terminal markings are given. The specification includes sections dealing with design and construction, and sets out in correct order the dielectric and performance tests to be carried out on the completed startor. The final section deals with information relating to the startor, supply circuit, motor and service conditions to be supplied to the maker with inquiry. An appendix gives a useful table of full-load currents for all standard sizes and voltages.

British standard specification No. 247, 1927, for alternating-current motor startors is similarly arranged to No. 246, but contains in addition all information relating to startors for alternating-current two and three-phase induction motors with slip rings. The appendix gives a list of full-load stator currents for all brake horse-power sizes at 230 v. and 400 v. for three-phase and 200 v. and 400 v. for two-phase motors. Copies of the new issues may be obtained from the publications department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each post free.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(*From our own Correspondent.*)

General Conditions.

THE position of the iron and steel industries in the Midlands and Staffordshire shows little change on the week, and the prospects in the heavy trades of the districts for the third quarter of the year being considered none too bright, the general outlook cannot be considered encouraging. There is a falling off in activity in motor engineering, constructional engineers are fairly well employed, but a substantial improvement is required, and general engineers report the situation to be erratic, with the general volume of business quiet. With the hand-to-mouth policy of buying still in operation, iron and steel masters in the Midlands cannot see many weeks ahead, and are forced to review the situation continually. Many are considering the advisability or otherwise of closing down until demand improves. There is a fair volume of work on hand, but orders are of small volume, and in some branches there is brisk competition to get hold of business so that, when secured, little profit results. The next two months are generally, more or less, quiet, and any improvement in trade is not now anticipated until the autumn.

Raw Iron.

The position in the pig iron department continues to show improvement, and hopes are expressed that a steady return to normal buying has commenced. Some fairly substantial orders have been placed for pig iron by foundries which had been holding off for a long time. Some of them have concluded contracts for supplies over the next two or three months. The operations of merchants are likewise significant. They have begun to operate cautiously on the assumption that prices are at or near the bottom. The business placed, however, has not been sufficient to satisfy smelters, whose stocks are rapidly increasing, and some Northamptonshire blast-furnaces, in order to secure business, this week lowered their minimum figure by 1s. 6d. per ton to £3 3s. 6d. for No. 3 foundry iron. For small tonnages the £3 5s. quotation was upheld, but contracts, it was claimed, could be placed at even below £3 3s. 6d. Derbyshire smelters did not show the same eagerness for business or weakness in quoting, and as most of them held on to the £3 10s. quotation, the disparity between the prices in the two districts widened to about 6s. 6d. Not long since the difference was 2s. 6d. Forge qualities of pig iron are quoted at about 5s. below foundry brands. Output of this quality is small, but there is practically no demand.

Manufactured Iron.

The Staffordshire wrought iron trade remains severely depressed, but the slightly better position in the shipbuilding industry has benefited Staffordshire makers of chain and anchor iron. Some of the most reliable authorities contend that the situation is worse than they have known it in the history of the trade. There has been no change in prices, makers being of opinion, in the light of recent events, that reduced prices would have no effect in stimulating demand. The general depression of trade has not affected the manufacture of cast iron pipes in Derbyshire. Producers are well situated for orders, both on home and export account.

Steel.

There is little if any change in the steel department. Business is comparatively quiet, and values are upheld despite the agitation amongst consumers for a reduction in steel prices commensurate with that which has taken place in pig iron. The constructional engineers are fairly good customers for building steel, and the works producing joists and sections are glad to give delivery on the customer's terms. Prices are unchanged at £7 12s. 6d. for joists and angles. There are comparatively few transactions of any magnitude, those taking place relating to small consignments for immediate use. Constructional engineers have not added much to their order books of late, and they can, they say, afford to wait for material. Plate mills are quoting £8 7s. 6d. for ship, bridge and tank plates, and £11 to £11 10s. for boiler-plates. They are anxiously seeking specifications. In semi-finished and finished steel, continental quotations remain substantially below native prices. Soft billets can be imported at £5 7s. 6d., as compared with the home price of £6 10s. to £6 15s., and foreign merchant bars cost £5 15., as compared with £7 15s. to £8.

Sheet Values.

Makers of galvanised sheets are not getting sufficient orders to insure the regular working of the mills, and have been bidding for more support from overseas markets by another reduction in the f.o.b. quotation. Business has been done this week at £14 5s. for 24-gauge corrugateds. A moderate amount of buying has resulted, Central America being the best customer. For the home trade £14 10s. is still quoted for small tonnages, but £14 7s. 6d. would be accepted for a good line.

Strip.

Makers of hot rolled strip are not well employed, only working about three days per week. Continental competition is a serious obstacle in the way of business, importations from Belgium and Germany being of considerable dimensions. Bright steel makers are only moderately employed, but inquiries are on the increase.

New Prices in the Iron Foundry Trade.

This has been a busy week with the light iron founders of the whole of the Kingdom. Whether Scotland, Yorkshire, Derbyshire or the Midlands are concerned, they have all been calculating the new prices at which

they are going to sell builders' castings, whether indoor or outdoor, and such-like goods in future. This follows, of course, upon what nearly, though not at present officially, amounts to the break up of which one has heard so much during the last fortnight of the outstanding iron-founders' trade organisation, the N. L. C. A. Founded as far back as 1912, and with at least thirteen years' effective work to its credit, this powerful body, which has kept together much longer than many an older price control organisation, has now got badly on the rocks, and the order "every man for himself," or something like it, has been given. The Scotch ironfounders of Falkirk and other Clyde centres have had the main hand in bringing about the wreck. They are the people accused of scuttling the ship, and, in truth, they made no effort to deny the charge. Their defence, as understood this week by the Birmingham light iron foundry trade, is that their interests were those most suffering from the maintenance of the *status quo*, and that the existing state of things had become intolerable. The "break up" of the association, if such phrase is yet permissible, takes the form of the termination of a price maintenance agreement which has existed for many years between the National Light Castings Association and the National Federation of Builders' Merchants and other wholesalers. The Association is a combination of manufacturers who control 95 per cent. of the output in this country of the castings used in the construction of houses, all of which goods have for thirteen continuous years sold at a carefully regulated price under the agreement. The goods include cast iron enamelled baths for house interiors, domestic grates, stoves, ranges, door-fittings, rain water gutterings, drain covers, and a host of other essentials. Indeed, the price catalogue issued to the merchants by the manufacturers included no fewer than 6000 different items.

Continental Competition Breaks British Combine.

For a long time past German and other continental competition, encouraged by the very lucrative market which the existence of the British N. L. C. A. made for it, has been severe in builders' iron castings, and particularly in enamelled house baths. Every year and almost every month the imports from the Continent have continually mounted. The issue has been that the Scotch bath founders have witnessed this very valuable branch of their trade steadily deserting them for the foreigner. It is to stop this "rot" that the Clyde makers state this week they have been forced to abandon all price rebate agreements with the builders' merchants and other distributors. Every iron founder is now to have a free hand in cutting prices, and it is to be feared that we are in for an intensive warfare between the larger makers of the Kingdom to secure customers. This is likely to involve the disbanding of the N. L. C. A., though for the moment any such official step is delayed.

Safety in Works.

There is an abundance of dissatisfaction in Midland industrial circles regarding the order recently issued by the Home Office for the purpose of increasing safety in factories on the line of appointing a supervisor in each factory. The works affected are blast-furnaces, rolling mills, engineering works of more than 500 employees, iron foundries of more than 50 employees, and shipbuilding works. Serious objection is taken to the proposed regulations, which are considered in many respects unnecessary and likely to prove an additional burden on Black Country industries at a time when they are not in a state to shoulder additional burdens. It is pointed out by Mr. H. D. Jackson, President of the Walsall Chamber of Commerce, that this country has the lowest accident record of all nations that keep statistics, and the proposal would mean an unfair addition to the burdens they had to bear. The appointment of a supervisor would not add to employers' liability to prevent accidents, and it seemed unfair to appoint a man who could be dismissed at a moment's notice by the employer to sit in judgment on the results of accidents. His qualifications would have to be such that it would be difficult to get a man of the right type. It would mean an absolutely unnecessary burden on employers, and he suggests that the Government could do a more sensible thing by asking the factory inspector to co-operate with the employer in putting into force safety first ideas.

Midland Miners' Wages.

Except for the Cannock Chase coalfield, where a serious state of affairs is disclosed, Midland collieries have come out of the recent ascertainments to decide upon wages for the present month, fairly satisfactorily. In South Staffordshire and East Worcestershire, miners' wages for July have been fixed at 51 per cent. on the basic rate, against 52 per cent. for June. The reduction is equal to about 1d. per shift. In the Warwickshire coalfield the percentage payable for July is reduced 2 per cent., being 63 per cent. on the basis rates, as against 65 per cent. For July the minimum wages for able-bodied men on the surface have been fixed at 7s. 6d., and underground 8s. 6d. The miners in this area seem pleased with the result—because they are not to suffer such a reduction in their wages as has taken place in other districts, while the owners are equally satisfied, as the figures showed that, notwithstanding the unsatisfactory position of the coal trade generally, and the deficits which the reports of accountants in other districts showed, the figures for Warwickshire disclosed for the months of March, April and May an average surplus of 1s. 9·9d. per ton, May being the only month showing a deficit, viz., 2·8d. per ton raised. In South Derbyshire the new terms will be 35 per cent. on the basic rate, being a drop of 17½ per cent. Stallmen will get 8s. 9d. per day instead of 9s. 11d., and there will be corresponding reductions for other grades. The subsistence rates will remain at 7s. 9d. per day for underground workers, and 7s. 5d. per day for men on the bank. A very different state of affairs is disclosed by the new ascertainment for Cannock Chase and Pelsall. In these areas wages for July will be subjected to the substantial reduction of 35·44 per cent. on the basis. This means a drop of 2s. 2d. per day in the minimum wage of stallmen, which will now be 9s. 4d. per shift, as against 11s. 6d. last month. Loaders will receive 8s. 4d., and able-bodied adult surface workers 6s. 8d. The percentage figure for July is 42 per cent., as against 75·44 in June, and is now down to the minimum. Indeed, I am given to understand that, but for the protective clause in the 1926 agreement assuring a definite minimum wage, the rate of pay for July would have been down to 40·56 per cent. on the basis, instead of 42. During the period upon which the July wages were based—March, April and May—there was, after the 42 per cent. minimum had been found, a deficit of over £7000 due to the coal-owners in profits. This £7000 will have to be paid to the owners from any profits that might accrue in the coming months. The ascertainment showed that in May there was a loss of 2s. 4d. on every ton of coal produced in the area.

Coventry Engineering.

The Coventry engineering industry is nothing like so brisk as it should be at this time of the year, and there is increasing evidence that the season's trade is coming to an end earlier than usual. A steady decline has been in progress for some time past, and there is now little prospect of a revival so far as the present season is concerned. If the weather which, along with the shortage of money, is claimed to be at the root of the trouble, picks up there may be some little recovery during the next few weeks, but, with few exceptions, the season is practically finished as far as the home market is concerned. Expectations are more or less confined to the export trade, and hopes are entertained that the end of next month will see some further expansion in overseas demand.

Wolverhampton Factory to Change Hands.

A provisional agreement has, I am informed, been made for the sale of Messrs. Macfarlane and Robinson's enamelled hollow-ware factory at Bushbury, Wolverhampton, to a firm of motor tire manufacturers. The works, which are laid out on the American pattern and are a quarter of a mile in length, were erected in 1916, and it is understood the purchase price is £75,000. An interesting feature is that the development is likely to bring another new industry to Wolverhampton. While the name of the purchasing company is not disclosed, I understand that a well-known organisation, chiefly associated with the manufacture of motor tires, but also a wide variety of articles ranging from rubber heels to airships, is behind the undertaking.

Edge Tool Industry.

After a lengthy spell of poor trade, extending from last autumn, the Midland edge tool industry is now experiencing a welcome improvement. Up to the present it has only been slight in character, and chiefly on home account, but hopes are entertained that the next month or two will see the advancement accelerated.

Unemployment.

Unemployment in the Midlands continue to show a satisfactory diminution, the latest returns recording a decrease of 5000 in a week. Whereas a week ago the total unemployed in the area was 138,586, it is now down to 133,885, of which 99,629 are men, 2709 boys, 27,110 women, and 4437 girls. The number on short time, which is included in the total previously given, now stands at 60,215, as compared with 66,014 a week ago. In the Birmingham area the number of unemployed has fallen from 24,106 to 22,338, but in the Coventry area it has increased from 2843 to 3131.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Manchester and the 2s.

THE offer of the Engineering Employers' Federation of an advance of 2s. a week to time workers, who, it is pointed out, represent about 48 per cent. of the employees in the engineering industry, has been the subject of a series of mass meetings in the Manchester district during the past week. At one held here on Sunday, Mr. John Hill, the general secretary of the Boilermakers' Society, said that three years ago when negotiations were opened with the Employers' Federation, the unions concerned were presented with a mass of figures that neither themselves as an executive body, the research department of the Labour Party, or specially engaged chartered accountants, had been able to fathom. In reply to the original demand for an increase of £1 a week they had received an offer of 2s., and the Central Executive had decided to leave the question of acceptance or refusal entirely to the men themselves. As the question is to be decided by ballot vote, no recommendations were accepted at the meetings, and it is not possible therefore to sense the general feeling of the men towards the employers' offer. At the same time, it should be pointed out that at the week-end meeting referred to, a good deal of individual opposition was in evidence. How far it represented the body of opinion in this important engineering centre it is difficult to say.

University Men in Industry.

Friday and Saturday of last week were degree days at Manchester University, and Dr. W. H. Moberly, the Vice-Chancellor, directed a portion of his address to the interests of the technological students. "Some of you," he said, "are going into industry, and those of you who have had special technical training are going into a world which is yet only half converted to the need for such training. It rests with you to convert it entirely. No amount of training in laboratory and lecture room is a substitute for the practical experience which you can only gain in the workshop, but it is for you to show a resourcefulness in invention and a patience and determination and thoroughness in testing the results of your experiments which will lead to the universities doing for British industry what they can do." University graduates, affirmed Dr. Moberly, got a rather doubtful reputation with the outside world because it was occasionally thought that the graduate went to his work or profession with the idea that he already knew all that there was to be known about it. What, of course, he had acquired was the ability to learn and the knowledge how to learn. The university graduate should be distinguished from those who had not had his training by the fact that he could learn much more quickly and profitably than the ordinary beginner.

Preventing Industrial Accidents.

Lieut.-Colonel Pickard, of the Safety First Association, in an address to the members of the Manchester Rotary Club, asserted that 75 per cent. of the industrial accidents in this country were due to the failure of the human element, and that the majority of them were preventable, not more than 10 per cent. being caused by the failure to guard machinery. These accidents, he said, were being prevented by many progressive firms throughout the country. Mather and Platt, Ltd., of Manchester, for example, and many firms in Sheffield, had reduced their accidents by from 50 to 75 per cent. by educating their operatives in the first principles of common sense. Colonel Pickard produced some startling figures when dealing with the statistical side of industrial accidents. In the course of a year, it was pointed out, nearly 500,000 people were sufficiently injured in their industrial occupations as to be awarded compensation, and the amount of compensation paid was over £6,000,000, a figure which represented only about one-quarter of the total cost of accidents in industry.

Proposed £150,000 Extension.

The Finance Committee of the Salford Corporation has approved of a proposal of the Electricity Committee to secure borrowing powers to the extent of £150,000 to cover the cost of an extension scheme at Agecroft power station which was opened in September, 1925. The proposal is to be considered at this week's meeting of the City Council. In a report on the scheme, which will be subject to the approval of the South-East Lancashire Electricity Advisory Board and the Electricity Commissioners, the city electrical engineer points out that the total capacity of the installation at the Agecroft station is 37,500 kilowatts, consisting of three sets of plant of 12,500 kW each. The buildings are capable of housing a fourth generating set, and it is recommended that this should be of 15,000 kW to 20,000 kW capacity, at an estimated cost of £150,000. On behalf of the Manchester Electricity Committee it is proposed to apply for powers to supply electricity to the parishes of Northenden and Northern Etchells and a portion of Baguley outside the area of supply from Altrincham.

Non-ferrous Metals.

The market for non-ferrous metals is in a decidedly jumpy condition. As is usually the case, tin has provided the most sensational features, although both lead and spelter, in a lesser degree, have bordered on the spectacular. Last week-end tin closed at about £300 for spot metal, but in the early days of this week there was an extraordinary reaction, a fall of £9 a ton bringing the metal to the lowest point since the middle of May. That this section of the market is largely a speculative one, in spite of the bullish talk of statistical strength, is borne out by the sudden fall. Sales have been on a limited scale, and it is probable that buyers will tread very warily for the next week or two. Except for occasional spurts, the demand for copper is quiet and the tendency is easy, although values at the time of writing are not much below what they were a week ago. Heavy offerings and a poor demand have had an appreciable influence on the lead market, and at the current quotations of about £24 per ton for prompt metal prices are nearly £6 per ton lower than at the beginning of March last, the fall on the week being about £1 5s. Spelter has also weakened, largely, it is said, in sympathy with the other metals, and here again quotations are at a low level.

Iron.

Although some makers of pig iron have this week reported a slight increase in interest in this metal, reports are by no means unanimous, and, generally speaking, conditions remain dull. Possibly somewhat more inquiry has been experienced than was the case last week, but that, I am afraid, is about the full extent of any improvement that may have occurred. Quotable changes are few, but the undertone of the market is less steady than would appear to be the case on the surface, and within reasonable limits sellers do not seem prepared to let business pass them for the sake of a concession. Cleveland No. 3 foundry iron is quoted here at about 83s. delivered Manchester or equal distance; Midland makes—Derbyshire and Staffordshire—ranging from 77s. 6d. to 78s., and hematite at 91s. to 91s. 6d. Scottish iron has further weakened slightly to 95s., at or about which figure sales were being made on this market before the general strike. Few forward contracts are being placed, and the bulk of the orders are for early delivery. Bar iron keeps up at £11 per ton for Lancashire Crown quality and £10 for seconds, but sales in this section of the market are still on an unsatisfactory scale.

Steel.

Constructional engineers locally have been receiving a steady flow of orders within the last week or two, but they have had little appreciable effect on the steel market, as their requirements can in most instances be satisfied against old contracts that are still running. Other users are content still to buy from hand to mouth, and interest in forward deliveries is at a low ebb. Possibly lower prices would stimulate the market to some extent, but an opportunity for such a test is still denied, for prices are held, sections being offered at £7 12s. 6d., general plates at £8 7s. 6d., boiler plates at £11 5s., and steel bars at from £8 to £8 12s. 6d., according to size. Galvanised sheets continue in very limited demand, and the market is weak and largely nominal at £14 5s. to £14 10s. per ton, f.o.b., for the usual Indian specifications. In view of the heavy stocks of imported steel held in this district, sellers of continental materials are securing few new orders of any weight, although there has been some inquiry in the market during the last few days for semi-finished products. Imported billets are quoted here at about £5 2s. 6d.,

sheet bars at £5 7s., joists at £5 12s. 6d. to £5 15s., Siemens plates at £7 7s. 6d. to £7 10s., ordinary plates at £7 to £7 2s. 6d., and steel bars at about £5 12s. 6d., including delivery to Lancashire works for cash against documents.

BARROW-IN-FURNESS.

Hematite.

The general position in the hematite pig iron trade of North Lancashire and West Cumberland is very far from being satisfactory. Business is slow on home account and there is little on offer from overseas. Workington and Barrow steel makers continue to take pretty good deliveries of metal direct to the furnaces, and will go on doing so for some weeks on orders in hand. There is more iron being smelted than can be sold, and the furnace at Carnforth has been put out and the works closed down. Prospects are moderate at present, but it is hoped that they will improve before long.

Iron Ore.

The demand for hematite iron ore has fallen with the lessened production of iron, business being mostly local. Foreign ores are coming in.

Steel.

Steel makers experience a slow demand for rails, both on home and overseas account. There are orders in hand to keep the plants busy for the whole of this month. A good output is being maintained at both Barrow and Workington. The demand for hoops is steady, largely on overseas account. The mills are well employed.

Fuel.

Both steam coal and East Coast and Cumberland sorts of coke are in lessened demand.

Shipping.

The shipping trade is quietly employed. Pig iron has been sent from Barrow docks to Calcutta and Boston, U.S.A., and steel hoops to Houston and to London for re-shipment overseas. The coastwise trade is dull.

SHEFFIELD.

(From our own Correspondent.)

Holiday Influences.

BUSINESS in the heavy trades has quietened down, and it is unlikely that there will be any revival during the next few weeks, at any rate. Stocktaking is proceeding, as is usual at the half year, and the holiday season is now getting well into swing; in short, the customary July conditions are now fully prevailing. For open-hearth steel there is no free buying. The market is limited, and users are content to take casual deliveries as required, and to leave any question of future commitments over for the time being. The general quietness prevailing need not be regarded too seriously, and there is a widespread feeling that trade will show a marked improvement next autumn. There are already sections of the steel trade which seem to have mastered the collection of difficulties which were left after last year's disastrous dispute. Up to now the balance sheets of the big steel and engineering companies have all reflected the financial losses and general disturbance caused by the stoppage in the coal industry, but the turning point is being approached, and has, in some cases, already been reached, though naturally it is heavy trades that are the slowest to recover. Special steels are reported to be doing fairly well and the business and inquiries for export are being maintained. The busiest firms are those specialising in work for the electrical and motor trades, and the former particularly keeps securing a very satisfactory succession of orders.

John Brown and Co., Ltd.

Lord Aberconway, presiding at the annual meeting at Sheffield of John Brown and Co., Ltd., dealt in some detail with the loss which the dispute last year inflicted on the company. The direct cost of the strike to the company's collieries and works could, he said, be taken at £175,000. At the Atlas Works the orders in May were of a very satisfactory character, and if they were continued on the same scale the company ought to have a very fair time during the rest of the year. They had some armour plate orders. The Davis wheel was making very good progress. The company had all the rights and the Railway Clearing House had authorised the unrestricted use of the wheel for wagons. One of the most interesting points with regard to the company's collieries was the announcement that it was proposed to renew the coking and by-product plant at Rotherham Main by putting down a Simon Carves plant. There are to be thirty-five new ovens instead of sixty-five as at present, and they are to produce more coke at a lower cost. This will make the third coke oven reorganisation scheme in this district to be announced recently, the other two being Nunnery Colliery and Tinsley Park Colliery, both in Sheffield.

Engineering Departments.

The engineering departments are not too well employed, but work is coming through fairly regularly, if quietly. Specialised lines are doing the best, and there are engineering products of Sheffield firms with a world-wide reputation which are more than holding their own. The railway plants are a little busier, but work is not coming through from overseas as freely as could be liked, or should indeed, be the case. Continental competition is very severe. Electrical work is proving one of the best sections, and the biggest firms have booked a series of excellent contracts which will keep the plants fully going for a considerable time. It is extremely gratifying to note that local firms are getting a good deal of work from abroad. Armament work does not make any headway, as, indeed, it cannot very well under the existing national restrictions, but activity on its recent scale is being fully kept up. Orders for more Army tanks have been received in Sheffield, and a start on three was made last week.

The Tool Trades.

Some sections of the tool trades have good order books. Files, rasps and saws have improved, and twist drills and pneumatic tools are other lines which, under prevailing circumstances, may be considered satisfactorily placed. A Sheffield business man who has recently returned from an extensive tour through the industrial districts of South Africa, where he has been superintending the installation of electric furnaces for the heat treating of drills and for the melting of gold, states that since he was there a year ago a big change in the method of buying drill steel has taken place. Instead of buying steel at the cheapest price per pound, the tendency now is to buy at the cheapest price per unit of work done. He also states that a tremendous amount of attention is being given in the Transvaal to the whole question of the life of hollow drill steel, and particular attention is being paid to the bore, the belief being held that the majority of breakages are due to corrosion cracks in the bore. The possibilities are now being considered of overcoming this difficulty by putting in a non-corrodible lining. Another big difference noted was the tendency to use smaller section steel, which will have the effect of calling for a higher quality material.

Plate and Cutlery.

There is very little business being done in the plate and cutlery trades, the bulk of the work being for stainless knives, forks and spoons. There is no doubt that the total quantity of work being produced each week throughout the city is considerably below the normal level at this period of the year. Silver and plate ware particularly are poorly patronised, though a valuable order for sterling silver placed by a wealthy Eastern customer has come, in part, to Sheffield. The order consisted of a silver dinner service, and the value is stated to be in the region of £10,000. Sheffield supplied the silver stampings and the finishing work was done in London.

University Mining Department.

A scheme for the erection of a new Mining Department at Sheffield University has matured sufficiently for work to begin. A site adjoining the Applied Science Department is available, and plans have been approved. During the last few years, the present Mining Department has so grown that the accommodation has become inadequate, and about three years ago a scheme was set on foot to provide funds for the erection of a new building. The Central Committee of the Miners' Welfare Fund was approached, and promised to provide £8000 as soon as a like sum had been raised locally. This condition has been largely met by the generosity of the South Yorkshire Coalowners' Association, and individual subscriptions from local colliery companies. The sum available for building has now reached £17,700. It is estimated that the cost of the site and completed building will be £21,200, in addition to which £3500 will be needed for equipment, which can be added gradually as need arises. When the scheme is carried out the University will possess one of the best equipped mining departments in the country, and will be able to provide both for the higher education of men in the mining industry and for the carrying out of important research work in mining problems.

New Foundrymen's President.

The annual convention of the Institute of British Foundrymen was held in Sheffield this week. The new President is Mr. John T. Goodwin, who is the general manager of the foundries and engineering departments of the Sheepbridge Coal and Iron Company, Ltd., of Chesterfield. He was apprenticed with the Butterley Company, Derbyshire, and has served with the Dearn and Duff Steel and Iron Company, the Holwell Iron Company, and Cochranes, Middlesbrough.

NORTH OF ENGLAND.

(From our own Correspondent.)

Trade Decline.

IT is difficult to avoid a note of pessimism in regard to the trade situation in the North of England. The coal trade, in particular, is passing through a very difficult time. Hardly a week passes by without announcements to the effect that men have been given notice at one or other pits, usually old pits, because trade is so bad to get and costs are somuch higher than before the war. The iron and steel trade, which reached the peak of its activity in the month of April last, is also on the down grade. Output is declining, and so, too, is the export trade. This fact is plainly indicated in the statistical record of exports from the Cleveland district during June, when only 85,663 tons of iron and steel were shipped, as compared with 92,656 tons in May and 106,323 tons in April. As a result of the recent cut in Cleveland pig iron prices, there was some slight improvement in the foreign shipments of pig iron, which totalled 7852 tons in May and 9709 tons in June, but although the latter is the best monthly total for the present year it represents only a fraction of the normal foreign trade of the district, and is offset by a fall in the shipments of pig iron to Scotland, which declined from 5049 tons to 2134 tons. The contraction in the shipments of manufactured iron and steel is indicated by the following figures:—April, 94,908 tons; May, 78,180 tons; June, 72,500 tons. In this instance the decline is chiefly due to a falling off in the orders from South America and India, although there has been some compensation in better steel shipments to Australia.

Iron and Steel Imports.

While the iron and steel trade of the district is languishing, imports of iron and steel from foreign countries continue on an exceptionally heavy scale. Statistics presented at this week's meeting of the Tees Conservancy Commissioners showed that during the eight months ended June 278,063 tons were imported, as compared with 133,799 tons in the corresponding period of 1925–26, and 47,944 tons in the pre-war period of 1913–14. Crude sheet bars, billets, blooms, slabs, &c., imported during the eight months totalled 150,715 tons, as against 84,092 tons in 1925–26, and 30,307 tons in 1913–14. The pig iron received amounted to 87,799 tons, as compared with 38,670 tons in 1925–26 and 218 tons in 1913–14, while the imports of plates, bars, angles, rails, sheets, joists, &c., totalled 39,549 tons, as against 11,037 tons and 17,419 tons respectively.

Big Losses in Coal Trade.

The latest ascertainments of proceeds and costs in Northern coalfields emphasise the grave uneconomic condition into which the industry has drifted. The ascertainment for Northumberland shows that the wages would be 34·37 per cent. over basis rates if the miners were not protected by a minimum of 80 per cent. under the county agreement. In June the percentage, the result of the April ascertainment, was 35·95, so that the reduction in the latest figures is 1·58 per cent. The trading loss is exceedingly heavy, as the owners during the current month will have to make up 45·63 per cent. in the wages, being the difference between 34·37 per cent., the economic yield of the coal, and the minimum percentage on basis wages. The Durham ascertainment shows that the trading results in May were slightly better than in April, but still leave a heavy deficiency. But for the minimum of 89 per cent. over basis wages, the miners would receive in July 54·01 per cent. over the basis, compared with 49·99 per cent. in June, so that there is an increase of 4·02 per cent. on the month. To pay the 89 per cent. minimum the owners will therefore have to make up 34·99 per cent., compared with 39·01 in June.

Cleveland Iron Trade.

The Cleveland pig iron market is still very languid, but since the end of the half year a few more inquiries have been circulating. The trouble is that most of them are for very small quantities. Buyers still lack the confidence to embark upon other than hand-to-mouth transactions, and even foreign buyers when they can be induced to place an order are only purchasing very small quantities. The import of pig iron from abroad has not been entirely stopped, but the Cleveland market is now fairly secure, and it is in Scotland that the effect of continental competition is most keenly felt. The Cleveland ironmasters, however, have not a great deal of iron to sell, and they firmly adhere to their recent prices, viz., No. 1 Cleveland foundry iron, 72s. 6d.; No. 3 G.M.B., 70s.; No. 4 foundry, 69s.; and No. 4 forge, 68s. 6d. per ton.

Hematite Pig Iron.

There has been a little more movement in the East Coast hematite pig iron trade. Small orders are the rule, but in the aggregate they seem to be sufficient to absorb a limited output, and it is encouraging to note that there is a steady trade with Italy. It should be added, however, that most of the foreign sales are of hematite of special analysis, and ordinary mixed numbers are not asked for. Mixed numbers are quoted at 77s. per ton, and No. 1 quality at 77s. 6d. per ton.

Ironmaking Materials.

Stocks of foreign ore are accumulating rather rapidly as a result of imports against old contracts. No new business is reported, and best Rubio ore remains nominal at 22s. per ton c.i.f. Tees. Coke is weak, but sellers still ask 20s. per ton for good furnace brands delivered at the works.

Blast-furnacemen's Wages Reduced.

The ascertainment issued by the Cleveland Ironmasters' Association on Wednesday certified the average net selling price of No. 3 Cleveland pig iron for the past quarter to be 74s. 6·61d. per ton. In accordance with the sliding scale arrangement, this means a reduction of 3·50 per cent. in blast-furnacemen's wages, which will bring them from 24 per cent. to 20·50 per cent. above the standard. The reduction takes effect from the 3rd inst.

Manufactured Iron and Steel.

An encouraging feature of the manufactured iron and steel trade is the fact that imports of foreign material are on the decline. Still, foreign competition is keen and foreign prices are much below those of manufacturers in this area. This, no doubt, strengthens the belief that British makers will be unable to resist the bear pressure, and there is apparently a disposition on the part of buyers to place orders only for minimum quantities until price concessions are made. Some of the works still have healthy order books, but new specifications are only coming along slowly. Big sales of galvanised corrugated sheets to Japan are reported, but the price is rather easier owing to the recent fall in spelter and the cheapness of foreign sheet bars.

The Coal Market.

There is no development in the Northern coal trade. The outlook for spot trade is lifeless, and for all July most disappointing. Even a combination of low coal prices and sharp decline in freight rates fails to prove attractive to the foreign consumer, and it appears definite that not prices but lack of consumptive demand is the cause of the slow trade available. Fitters confine themselves to securing the little prompt business available, and for these lots make concessions, but beyond hand-to-mouth clearance they stand steady to the recent range, both for July and more forward shipment. Best Northumberland steams for spot are about 14s. and forward 14s. 3d. Steam smalls are firm, but business is slow owing to the limited supplies, and in most qualities buyers can only cover smalls by combining orders for screened. Prices range from 9s. 6d. for ordinary qualities to 10s. 6d. for Tyne primes. In Durhams there is an ample supply of

gas coals at nominally steady prices. Best qualities are offered at 16s. to 16s. 6d., and seconds at 14s. to 14s. 9d. Coking coals are about steady, despite limited demands, at 13s. 9d. to 14s. 3d. Manufacturing cokes are meeting a slow demand, and under abundant output prices are weakly held. Good patent qualities are 18s. to 19s.; special makes, 25s. to 26s.; beehive, 28s. to 32s.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE returns from Clyde shipyards for the month of June show a considerable advance on the previous best for any single month this year at twenty-eight vessels of 40,465 tons aggregate. The aggregate returns for this year to date, however, are lower than for the corresponding period last year, at 100 vessels of 145,171 tons, against eighty vessels of 158,552 tons. Of the vessels launched during June, four were between 3000 and 4000 tons each, three were between 5000 and 6000 tons, and one of 7000 tons. The four vessels of 5000 tons and over are as follows:—Itape, twin-screw motor ship, 5000 tons, built for the Companhia Nacional de Navegacao Costiera, Rio de Janeiro; Benvenue, cargo, 5930 tons, for William Thomson and Co., Leith; Grantleyhall, cargo, 5000 tons, for the West Hartlepool Steam Navigation Company, Ltd., West Hartlepool; and the Pacific Reliance, twin-screw motor ship, 7000 tons, built for the Norfolk and North American Steam Shipping Company, Ltd., London. Contracts reported during the month included two motor cargo ships, each between 10,000 and 11,000 tons, to be built at Scotstoun and another of similar dimensions to be built in a yard on the lower reaches of the river. Employment at the yards increases slowly, but a fair number of contracts are on hand, and if peace in the industry can be guaranteed for a period, an acceleration of output will soon follow.

Light Castings Trade and Competition.

Severe foreign competition has been given as the reason for a complete change of policy on the part of the Light Castings Association, an organisation which has always been regarded as a most effective one, whose operations were often cited as sufficient reason for the setting up of similar associations throughout the country. The severe competition referred to has resulted in the termination of price maintenance agreements between foundries and merchants, as the former expect thereby to cope more successfully with the altered conditions in the market. For many years the trade has been in a flourishing condition, but during the past twelve months competition, especially from Germany, has completely altered the whole aspect. It has been said that many merchants observed the price agreements, but to others the greater profits to be made from the foreign article became altogether too tempting. Hence this change of policy.

Steel and Iron.

The position in the steel and iron trades is one of unrelieved dullness, and it is difficult to find any feature calculated to give encouragement. The flow of orders for all classes of material is extremely limited, and many producers are now working on specifications received from week to week. Steel sheets have been comparatively busy, but have slackened off temporarily at least, though prices do not show any particular weakness as yet. The demand for scrap is only moderate. Heavy steel scrap is about 67s. 6d. and heavy basic 62s. 6d. per ton, and holders are inclined to adhere to these figures. Consumers of bar iron and re-rolled steel bars are buying most cautiously. Crown iron bars for home delivery are unchanged, but export might be done under £10 10s. per ton. Re-rolled steel bars are also inactive at £8 2s. 6d. home and £7 12s. 6d. per ton export.

Pig Iron.

Business in pig iron continues to shrink. The steel works require smaller deliveries of hematite, while foundry qualities experience keen competition from English as well as foreign products.

Coal.

There has been little, if any, change in the Scottish coal market during the week. Lanarkshire splints remain firm, and constitute the feature in round coals. Fifeshire steams have been a shade busier, but are still comparatively easy in price, as are most descriptions of round fuel. Washed materials, and especially treble and double nuts, are very firm in all districts, owing to better demands and an increasing scarcity of supplies. Aggregate shipments amounted to 241,597 tons, against 236,562 tons in the preceding week and 208,071 tons in the same week in 1925.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THE conditions in the steam coal trade have by no means improved during the past week. It cannot, unfortunately, be denied that they have become worse, and on every hand in commercial circles one hears that nothing like the existing conditions has ever been experienced before. It is true, at any rate, that increased numbers of workmen are idle or are under notice, that shipments have fallen away, and that values have further declined. In fact, generally speaking, present prices are very much on a level with those of 1913. The inquiry from abroad is almost negligible and, of course, everyone is wondering how long these conditions are going to last. Shipments last week were less by about 50,000 tons than they were the previous week, and it is scarcely likely that the figures for the current week will register any improvement. The number of idle loading appliances at South Wales docks at the end of last week was 44, and this week commenced under very little better auspices, inasmuch as, notwithstanding tonnage arrivals over the week-end, there were 38 idle loading appliances on Monday. Stocks of coal of all classes are excessive, notwithstanding the curtailed production, it being estimated that on Tuesday quite half the steam coalfield was idle. No precise information on this point is available, but, while this estimate may actually be a slight exaggeration, it is to be feared that on the whole it is not far from the truth. Still, depressing as the conditions are, and probable as it is that they will continue for perhaps two or three months, there is a brighter side to the picture. It is reported that the home demand is a shade better, and if that could be substantially increased it would make a very considerable difference to the amount of coal available for export. Furthermore, there is a feeling that values have touched bottom, and coalowners and their salesmen are making a more determined effort to resist any further decline. In fact, the point has been reached when coalowners have to make up their minds whether pits are to be worked any longer if increased orders and better prices cannot be secured. Already the irregular working of so many collieries is creating some difficulty for exporters who have certain commitments to execute, and, on account of the suspended working of pits, cannot obtain the quantity of smalls which they contracted for. It is quite easy to see that the stoppage of collieries right and left may, in a very short time, put a different complexion on market values, but the great thing is to convince the foreign buyer that the market generally has touched bedrock. Naturally, buyers will not operate as long as they think there is a possibility of saving a few pence per ton, but there is such a thing as overdoing this and missing their market.

S. W. M. F. Conference.

At the end of last week the annual conference of miners' delegates from this coalfield took place at Cardiff, when resolutions on a great variety of subjects were passed. The programme, on the whole, displays very little departure from that outlined on previous occasions. The Conference agreed that membership of the Federation should be a condition of employment in the coalfield, and carried a resolution that the abolition of the double shift should be pressed for. The Executive Council was called upon to proceed immediately with the drafting of a pensions scheme for aged miners, preferably that this should be a national scheme and that all benefits should be maintained from the Miners' Welfare Fund. It was also carried that immediate steps should be taken to get colliery firemen and examiners employed by the State, and it was urged that a policy of rigid economy should be pursued with a view to setting up a reserve fund to be earmarked for giving benefit to members during an official strike. Five resolutions were passed on the subject of holidays, and it was agreed that all steps should be adopted to secure the withdrawal of the eight hours' day and its substitution by a six hours' day, that pit-head baths, to be charged for out of the profits of the industry, should be installed, and that payment for small coal should be included in proposals for any new agreement.

Non-Unionism.

In addition to a large number of collieries being idle on account of the depression in trade, there was a suspension of operations at the bulk of the collieries in the Maesteg area on Tuesday consequent upon non-union trouble. About 7000 men are affected. Strike notices were tendered about a fortnight ago. It appears that the point in dispute is between the South Wales Miners' Federation and the Craftsmen's Association. Some of the workmen have joined the latter organisation, and the Federation is bent on getting all the men back into the Federation. The Craftsmen's organisation is described by the miners as a rag-tag bob-tailed organisation of the coalowners. On the other hand, the officials of the Craftsmen's Union state that the members are determined to remain loyal and to break down the dictatorship of the opposition, and that they are prepared to continue the struggle in defence of their members who claim the right of choosing their own society.

Tin-plate Trade.

The annual meeting of the Joint Industrial Council of the tin-plate industry was held at Swansea on Monday, when the main subject under discussion was an appeal from the men's side that the pooling arrangement adopted by many employers should be amended so as to provide for a more equal distribution of the work available. The contention was that at present the arrangement meant that some men were continuously out of work owing to the scheme being applied to works instead of to mills. Three alternatives calculated to remove grievances were put forward for the consideration of the employers. On the employers' side it was pointed out that the pool was altogether outside of the employers' association. In fact, a substantial percentage of the members were not parties to it. It was contended that the operation of the pool was not responsible for the inequalities complained of, the real reason for the stoppage of certain works being the lack of orders for the particular description of plates which they produced. It was ultimately agreed, with the approval of the representatives of the particular works mentioned, that the men's representatives should meet them in Conference and see if the grievance could not, by mutual arrangement, be removed. Failing this the employers agreed that a further meeting of the Council should be convened to consider the three proposals submitted by the men.

Current Business.

The steam coal market displays a very dull tone in all departments. The demand for coals for shipment promptly is meagre in the extreme, and so far as contract coals are concerned, exporters have difficulty in lifting them, as they find that their receivers are anxious to postpone deliveries as far as possible. Values of all qualities are for the most part nominal, although the very best Admiralty large could probably be obtained for immediate loading as low as 20s. 6d. The state of the coal trade is reflected in the conditions prevailing as regards the demand for pitwood. This is very quiet, and, notwithstanding that there is comparatively little wood offering, prices are weaker and are down to about 26s. 6d. to 27s.

IRON AND STEEL INSTITUTE.

THE autumn meeting of the Iron and Steel Institute will be held at Glasgow on Tuesday, Wednesday, Thursday and Friday, September 20th to 23rd, and an outline of the arrangements that have been made is given below.

On Monday, September 19th, the secretaries' office will be open from 3 to 6 p.m., at the Royal Technical College, George-street, Glasgow, for registration of members and the distribution of programmes, badges, &c. On the Tuesday morning at 10 o'clock the Institute will be welcomed by the President of the West of Scotland Iron and Steel Institute, the Lord Provost of Glasgow, and the President of the Chamber of Commerce, in the Examination Hall of the Royal Technical College. Thereafter there will be a general meeting of members, in the Societies' Room, for reading and discussion of papers. In the afternoon there will be the following alternative visits to works: (1) David Colville and Sons, Ltd., Clydebridge Works; (2) Fredk. Braby and Co., Ltd., Eclipse Works; (3) Steel Company of Scotland, Ltd., Blochairn Works; and (4) Babcock and Wilcox, Ltd., Renfrew. In the evening there will be a reception and dance in the City Chambers, by invitation of the Lord Provost and the Corporation of the City of Glasgow.

On the Wednesday at 10 a.m. further papers will be read and discussed, and in the afternoon there will be the following alternative visits to works:—(1) Wm. Beardmore and Co., Ltd., Mossend Works; (2) Stewarts and Lloyds, Ltd., Clydesdale Works; (3) Glasgow Iron and Steel Company, Ltd., Wishaw Works; (4) Smith and McLean, Ltd., Gartcosh Works; and (5) Mavor and Coulson, Ltd., Mile End, Glasgow.

The morning of the Thursday will again be devoted to the reading and discussion of papers, and the following alternative visits to works have been arranged for the afternoon:—(1) Scottish Iron and Steel Company, Ltd., Waverley Works; (2) Wm. Bain and Co., Ltd., Whifflet Works; (3) Scottish Tube Company, Ltd., Coatbridge Works,; and (4) R. B. Tennent, Ltd., Coatbridge Works. In the evening there will be a supper dance at the Central Hotel.

For Friday, September 23rd, arrangements have been made by the Reception Committee for an all-day excursion on the Firth of Clyde in ss. King George V.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. SYDNEY BRYAN DONKIN, M. Inst. C.E., M.I. Mech. E., M.I.E.E., has been elected chairman of the Committee of the Association of Consulting Engineers for the year 1927–1928.

BROOK MOTORS, Ltd., the head office and works of which are at Huddersfield, asks us to announce that its office covering London and district is now at Aldwych House, London, W.C. Telephone, 7192-3 Chancery; telegrams, "Phasebroo Phone."

REAVELL AND CO., Ltd., of Ranelagh Works, Ipswich, ask us to announce that Haslam and Stretton, Ltd., of 11, Windsor-place, Cardiff, have taken over the representation in South Wales and district for them, and also for the Reavell-Mossay Pneumatic Tool Company, Ltd.

FOAMITE FIREFOAM, Ltd., asks us to announce that it has moved its head office from 24–26, Maddox-street, Regent-street, to 55–57, Great Marlborough-street, London, W. 1. Telegrams, Foamite, Wesdo, London; telephone, Regent 3105–6–7.

VICKERS LTD. inform us that Mr. F. Dudley Docker, C.B., the Right Hon. R. McKenna, and Sir William Plender, Bart., G.B.E., have notified the board of Vickers Ltd. that in their opinion the time has arrived when they can properly relinquish their position as advisers to the board, which position they were invited to occupy at the request of the board and with the approval of the shareholders, at the time of the reconstruction of the company. Mr. George R. T. Taylor has been appointed deputy chairman of the company.

THE INSTITUTION OF ELECTRICAL ENGINEERS: STUDENTS SECTIONS.—The annual Summer Meeting of the Students' Sections of the Institution of Electrical Engineers will be held this year in the Midlands and the North of England. The majority of the party will leave London on Saturday afternoon, August 13th, for Rugby, where a few days will be spent, and from there will go to Manchester and Liverpool, returning to London on August 21st. The programme arranged includes an all-day motor trip from Matlock to Manchester. Permission has also been given to visit the works of (*a*) the British Thomson-Houston Company, Ltd.; (*b*) the Metropolitan-Vickers Electrical Company, Ltd.; (*c*) the Ford Motor Company; and (*d*) British Insulated Cables; as well as the Rugby Radio Station and the Barton power station.

WHITWORTH SOCIETY.—The summer meeting of the Society was held in Derby on Thursday, June 30th, on the same day that the members of the Institution of Mechanical Engineers were visiting various works in Derby. Members of the Society who were not members of the Institution of Mechanical Engineers were entertained at luncheon by the London, Midland and Scottish Railway Company. Thirty-three Whitworth men then went by char-à-banc to Darley Dale Church, where a wreath was deposited on the tomb of Sir Joseph Whitworth by Dr. F. P. Purvis, the President. The party then proceeded to Bakewell, where they had tea, and the dinner was held at the Midland Hotel, Derby, when thirty-four members were present. The new President, Mr. Thos. Sugden (Wh. Sc., 1873) was installed in the chair, and a number of interesting speeches were made. There are now 503 members on the roll, and further particulars may be obtained from the hon. secretary, Whitworth Society, c.o. the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	18/6 to 21/-
(1) Spanish	18/6 to 21/-
(1) N. African	18/6 to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	22/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 2 6	
No. 1 Foundry	4 5 0	—
No. 3 Foundry	4 0 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 17 0	3 17 0
No. 1	3 17 6	3 17 6
Cleveland—		
No. 1	3 12 6	3 12 6
Silicious Iron	3 12 6	3 12 6
No. 3 G.M.B.	3 10 0	3 10 0
No. 4 Foundry	3 9 0	3 9 0
No. 4 Forge	3 8 6	3 8 6
Mottled	3 8 0	3 8 0
White	3 8 0	3 8 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 12 6	—
,, ,, Foundry	4 1 6	—
(3) Northampton—		
Foundry No. 3	3 3 6 to 3 5 0	
Forge	3 0 0	—
(3) Derbyshire—		
No. 3 Foundry	3 10 0	—
Forge	3 5 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 12 6	—
No. 4 Forge	—	—
Basic	3 12 6	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 11 6 (a) / 4 14 6 (b) / 4 18 0 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 15 0	10 10 0
Best	—	—
N.E. COAST—		
Iron Rivets	12 5 0	—
Common Bars	11 5 0	—
Best Bars	12 5 0	—
LANCS.—		
Crown Bars	11 0 0	—
Second Quality Bars	10 0 0	—
Hoops	14 0 0	—
S. YORKS.—		
Crown Bars	11 10 0	—
Best Bars	12 5 0	—
Hoops	14 0 0	—
MIDLANDS—		
Crown Bars	10 15 0 to 11 0 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolt Bars	10 5 0	—
Gas Tube Strip	12 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	11 0 0	11 0 0
Ship Plates, ½in. and up	8 2 6	7 12 6
Sections	7 12 6 to 7 15 0	7 2 6
Steel Sheets, under 3/16 in. to ½in.	10 0 0 to 12 0 0	
Sheets (Gal. Cor. 24 B.G.)	— £15 0 0 to 16 0 0	

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 2 6	—
Angles	7 12 6	—
Boiler Plates	12 10 0	—
Joists	7 12 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 12 6	—
Soft Billets	7 12 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	
Billets	8 0 0 to 11 10 0	
MANCHESTER—		
Bars (Round)	8 15 0	—
,, (Small Round)	8 0 0	—
Hoops (Baling)	11 0 0	11 0 0
,, (Soft Steel)	10 0 0	10 0 0
Plates	8 7 6	—
,, (Lancs. Boiler)	11 5 0	—
SHEFFIELD—		
Siemens Acid Billets	11 0 0	—
Hard Basic	8 2 6 to 8 12 6	
Intermediate Basic	7 15 0	—
Soft Basic	7 5 0	—
Hoops	11 10 0	—
Soft Wire Rods	9 5 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 10 0	
Billets and Sheet Bars	6 15 0 to 7 0 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	14 5 0 to 14 10 0	
Angles	7 12 6	—
Joists	7 12 6	—
Tees	8 12 6	—
Bridge and Tank Plates	8 7 6	—
Boiler Plates	11 0 0 to 11 10 0	

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/9 to 19/-
Block Tin (cash)	291 0 0
,, (three months)	282 0 0
Copper (cash)	53 7 6
,, (three months)	53 17 6
Spanish Lead (cash)	22 17 6
,, (three months)	22 6 3
Spelter (cash)	27 10 0
,, (three months)	27 7 6
MANCHESTER—	
Copper, Best Selected Ingots	58 10 0
,, Electrolytic	60 0 0
,, Strong Sheets	84 0 0
,, Tubes (Basis Price) lb.	0 1 0½
Brass Tubes (Basis Price) lb.	0 0 11½
,, Condenser lb.	0 1 1½
Lead, English	24 10 0
,, Foreign	23 15 0
Spelter	27 17 6
Aluminium (per ton)	£107

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/9½ per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 10 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£22 15 0	7/3
,, ,, 8 p.c. to 10 p.c. ,,	£22 7 6	6/6
,, ,, Specially Refined		
,, ,, Max. 2 p.c. carbon	£36 5 0	11/6
,, ,, ,, 1 p.c. ,,	£42 5 0	15/-
,, ,, ,, 0.70 p.c. carbon	£54 0 0	17/6
,, ,, ,, carbon free	1/5d. per lb.	
Metallic Chromium	3/3 per lb.	
Ferro Manganese (per ton)	£12 10 0 for home, £16 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 5 0 scale 5/- per unit	
,, ,, 75 p.c.	£19 5 0 scale 6/- per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	5/- per lb.	
,, Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£170	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.

(Prices not stable.)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/6
,, ,, Ell	14/-
,, ,, Splint	15/3 to 17/6
,, ,, Trebles	16/6 to 17/-
,, ,, Doubles	16/- to 16/6
,, ,, Singles	13/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	14/-
,, ,, Jewel	15/6
,, ,, Trebles	16/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	11/9 to 13/9
Screened Navigation	18/- to 19/-
Trebles	16/6 to 17/-
Doubles	15/6 to 16/-
Singles	13/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/9 to 13/-
Secondary Steam	12/3 to 12/6
Trebles	16/3 to 16/6
Doubles	15/- to 15/6
Singles	13/6

ENGLAND.

(8) N.W. COAST—	
Steams	26/6
Household	42/6 to 58/6
Coke	25/6 to 26/6
NORTHUMBERLAND—	
Best Steams	14/6
Second Steams	13/- to 13/6
Steam Smalls	10/6
Unscreened	13/- to 13/6
Household	21/- to 27/-
DURHAM—	
Best Gas	16/- to 16/6
Second	14/- to 14/6
Household	21/- to 27/-
Foundry Coke	19/- to 26/-

SHEFFIELD—	Inland.	
Best Hand-picked Branch	27/6 to 28/6	—
Best Selected House Coal	21/- to 22/6	—
Screened House Coal	19/- to 21/-	—
,, ,, Nuts	16/- to 17/6	—
Yorkshire Hards	16/- to 17/-	—
Derbyshire Hards	16/- to 17/-	—
Rough Slacks	10/6 to 11/6	—
Nutty Slacks	8/- to 9/-	—
Smalls	3/- to 5/6	—
Blast-furnace Coke (Inland)	22/- *	—
,, ,, (Export)	f.o.b.	18/6 to 20/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/- to 21/-
Second ,,	19/6 to 20/-
Best Dry Large	19/- to 19/6
Ordinary Dry Large	18/6 to 19/-
Best Black Vein Large	19/- to 19/6
Western Valley Large	18/- to 18/6
Best Eastern Valley Large	17/6 to 18/-
Ordinary ,, ,,	17/- to 17/6
Best Steam Smalls	13/- to 14/-
Ordinary Smalls	12/- to 13/-
Washed Nuts	18/- to 21/6
No. 3 Rhondda Large	21/- to 21/6
,, ,, Smalls	16/- to 16/6
No. 2 ,, Large	17/- to 17/6
,, ,, Through	15/6 to 16/-
,, ,, Smalls	13/- to 13/6
Foundry Coke (export)	40/- to 42/6
Furnace Coke (export)	30/- to 32/6
Patent Fuel	23/6 to 24/6
Pitwood (ex ship)	26/9 to 27/3
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	38/- to 42/-
Seconds	30/- to 35/-
Red Vein	25/- to 30/-
Machine-made Cobbles	45/- to 47/6
Nuts	40/- to 45/-
Beans	30/- to 35/-
Peas	19/- to 21/-
Breaker Duff	8/- to 8/9
Rubbly Culm	9/- to 9/6
Steam Coals:	
Large	20/- to 21/-
Seconds	18/- to 20/-
Smalls	11/- to 12/-
Cargo Through	16/- to 17/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow.

(b) Delivered Sheffield. (c) Delivered Birmingham. * Official quotation for pig iron producers.

French Engineering Notes.

(From our Correspondent in Paris.)

Trade Decline.

THE decline in the iron and steel trades has become so general that it is difficult to see in what direction it is possible to look for an improvement. The continuous fall in railway traffic receipts and the business reports of banks testify to the growing depression. Amongst the adverse influences at work is the uncertainty that exists regarding the stabilisation of the franc, for, while it is stated that stabilisation will be brought about in the early future, no one knows on what basis it will be effected, and it is evident that, if it proceeds by stages towards a revalorisation, each stage will result in putting business out of gear. The last few months have shown that it is extremely difficult to adjust prices to new monetary values. Another unsatisfactory element in the situation is the high price of coke, which is placing French pig iron producers at a great disadvantage as compared with the British, and it is observable that, while the British demand for continental steel has fallen off of late, the competition of British steel producers is becoming increasingly keen. The effect of that is to weaken continental steel prices, and bars for export have been selling at £4 12s. per ton f.o.b. Antwerp, as compared with £5 8s. in 1913. It is now proposed to diminish the steel production. In the engineering trades little is being done at present except in the shipyards and by builders of railway rolling stock. These latter received during the past month orders to the value of more than 36 million francs, and some further large orders are to be distributed shortly.

Engineering Development.

The negotiations between France and Germany for a treaty of commerce having been broken off until it is possible to resume them on a definite basis after the passing of the new Tariff Bill, the situation has become critical through the practical cessation of business between the two countries. The temporary arrangement which expired on June 30th has not been renewed, and in view of the fact that France is the greater loser thereby, it is probable that something will be done to find a temporary solution of the difficulty. That cannot be delayed much longer without causing an industrial crisis in Alsace and Lorraine, where the metallurgical firms look to Germany as their principal and almost exclusive market. It is obviously impossible to renew the temporary agreement by accepting Germany's claims to the minimum tariff until the end of the year. That course is strenuously opposed by the French engineering trades, which are urging an immediate adoption of the new Tariff Bill as offering them the only means to develop in face of foreign competition, but the Tariff Bill itself has raised international problems that make the Government hesitate to resume the debate until it has been modified in a way to meet objections. At the same time, the engineering industries insist on there being no diminution of the protection that has been promised them. The secretary of the Fédération de la Mécanique has been carrying on an active campaign in favour of higher duties on imported machinery by showing the importance of the engineering trades and the disastrous results that it is alleged would follow if they were not sufficiently protected. He affirms that the annual turnover of all industries employed in transforming metals is 30,000 million francs. Of this amount, 8000 million francs, including 2500 million francs of motor cars, are exported. The trades give employment to about 1,200,000 hands, and the total annual wages bill is approximately 12,000 million francs. Before the war, the import duties on engineering goods is said to have represented from 6 to 8 per cent. of their value. That was hopelessly insufficient, and now that the industry has developed so enormously, the Fédération de la Mécanique claims that it must be adequately protected.

Hydraulic Engineering.

Anything appertaining to water lifting and irrigation is of particular importance in North Africa, where the prosperity of vast regions depends upon the means provided for the distribution of water. A great deal has already been done in Algeria and Morocco to render fertile great areas of territory by the creation of artificial reservoirs, and the Algerian Government has shown particular enterprise in extending the irrigation system wherever possible. During the second half of October next a Congress, devoted entirely to irrigation for agriculture and other purposes, is to be held in Algiers. An exhibition of plant and machines for boring and for water lifting, as well as of every kind of apparatus associated with irrigation, will be organised. During the Congress one day will be devoted to the question of cotton growing in North Africa. The Congress is being organised by the Confédération Générale des Agriculteurs d'Algerie, 2, rue Combes, Algiers.

The "Mountain" Locomotive.

Nearly two and a-half years ago the Paris, Lyons and Mediterranean Company and the Est Railway Company put into service, experimentally, a new type of extremely powerful locomotive known as the "Mountain," constructed by the Etablissements Schneider, of Creusot. It was intended to accelerate the service on lines with a particularly difficult profile, such as exist in the east of France and along the Riviera, where it is often necessary to reduce the number of coaches or employ two locomotives. The trials were entirely satisfactory, and an order for a hundred "Mountain" type locomotive was placed by the P.L.M. Company with Creusot. The first two have just been delivered. They are 4–8–2 machines, and give a striking impression of power and speed, with ogival-shaped front and squat chimney and steam dome on a boiler of huge dimensions. The weight of the locomotive is 120 tons, and with the tender loaded the total weight is close upon 200 tons. These locomotives will be employed mainly for hauling 1200-ton trains between Dijon and Laroche, Dijon and Vallorbe and between Marseilles and Nice.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

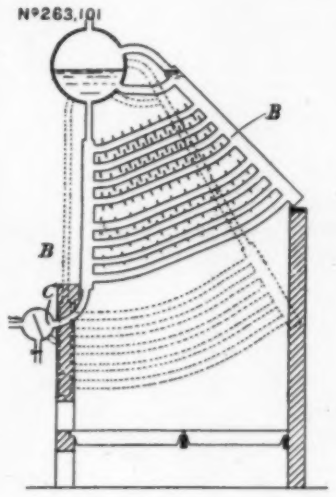
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

263,101. November 2nd, 1926.—IMPROVEMENTS IN WATER-TUBE STEAM BOILERS, Société Anonyme des Etablissements Delaunay-Belleville, of 1, rue de l'Ermitage, St. Denis (Seine), France.

The boiler described in this specification is claimed to give a high rate of evaporation on account of an improved distribution of work between the various tubes. The boiler consists of an upper drum and one or more tube elements placed side by side and connected with the drum. Each tube element is constituted by two headers B, to which the evaporative tubes, which are

N°263,101



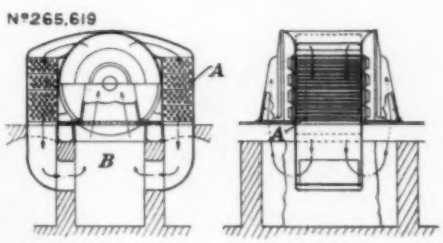
provided with gills, are connected. A feed and depositing drum C is connected with each element. The headers B of the same element are inclined at an angle as shown, and the tubes at the top of the boiler are consequently shorter than those at the bottom of the boiler. The passages for the gases, therefore, become shorter as the gases are cooled in rising through the tubes. If it is desired to increase the reserve of water more than one upper drum may be used. With the same object evaporative tubes of large diameter may be employed. The dotted lines indicate additional headers and tubes protecting the walls of the furnace.—*June 2nd*, 1927.

DYNAMOS AND MOTORS.

265,619. February 5th, 1927.—IMPROVEMENTS RELATING TO THE VENTILATION OF ELECTRICAL MACHINES, Allgemeine Elektricitäts-Gesellschaft, of 2–4, Friedrich Karl-Ufer, Berlin, N.W. 40.

In accordance with this invention the coolers for cooling the air of electrical machines are erected at the sides of the machine

N°265,619

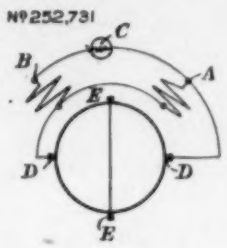


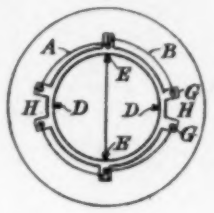
as shown at A, and the air circulates through the machine and coolers in the manner indicated by the arrows. The lower pit B through which the air passes must, of course, be made air-tight in order that impure air from outside may not be drawn into the machine. There are four other drawings.—*June 2nd*, 1927.

252,731. May 27th, 1926.—IMPROVEMENTS IN OR RELATING TO DYNAMO-ELECTRIC MACHINES, Maschinenfabrik Esslingen, of Esslingen, Germany.

The type of dynamo-electric machine to which this invention applies is a constant voltage machine, in which the excitation is obtained by means of the combination of the main exciting field, with a field produced by a current circulating through short-circuiting brushes placed between the main brushes. The main excitation of the machine is provided by two windings A and B, the winding A being directly connected across the main brushes D, so that the current varies with the voltage across these brushes, whilst the winding B is supplied through an iron wire resistance C, so proportioned that the current in this winding is constant. The main excitation is produced directly by the exciting winding, so that the current between the short-circuiting brushes, which serves only for regulating purposes, is naturally reduced, and the efficiency of the machine is high. With variations in speed or load or in both, the ratio of magnetising forces due to the coils varies. If, for instance, the terminal voltage of the machine rises above the normal value, the connections are such that the action of the winding A will predominate and a current will then flow in the short-circuiting brushes E, generating a magnetic field which will weaken the main field, so that the machine will give a practically constant voltage. The lower illustration shows a constructional form of the invention. The duplicate windings A and B are wound in slots G in the field magnet. The slots opposite the short-circuiting brushes E serve to produce the necessary conditions for commutation in the brushes E, and interpoles may also be provided at the point H opposite the main brushes. The usual compensating or compound windings may be provided or a standard exciting winding connected directly to the terminals, or in series with either of the coils

N°252,731



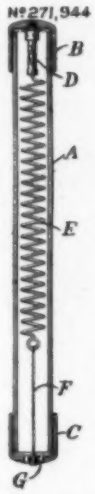


A and B, or with a resistance varying with the current or voltage and arranged to assist or oppose the fields of the coils A and B.—*June 2nd*, 1927.

SWITCHGEAR.

271,944. March 3rd, 1926.—IMPROVEMENTS IN OR RELATING TO ELECTRIC FUSES, A. Reyrolle and Co., Ltd., of Hebburn-on-Tyne, and Frank Coates, of Cranlea, Whitburn-road, Cleadon, Durham.

N°271,944

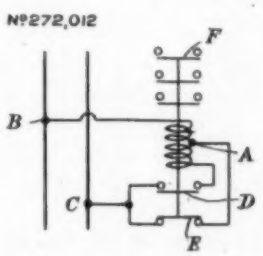


A fuse constructed in accordance with this invention is intended for use in places where it is desirable that the circuit should be broken, not only when the current is abnormally heavy, but also when the temperature of the apparatus to be protected rises above the permissible limit. In the drawing A is a glass tube having metal end caps B and C. Inside the cap B is a rod or plug D, composed of a metal or alloy of low-melting point. This rod is connected through a helix E to a fuse wire F, which is joined to the cap C. The helix E may act as a spring to keep the fuse wire fairly light, and whether it acts in that manner or not, it may be formed of high-resistance material. The unit is oil-immersed, and holes G are provided in the cap so that oil may enter to fill the tube A. The fuse wire melts in the ordinary way, whilst the alloy melts when the temperature of the surrounding medium exceeds a predetermined limit, regardless of the current. The two elements are connected in series with one another.—*June 7th*, 1927.

272,012. April 30th, 1926.—IMPROVEMENTS IN OR RELATING TO ELECTRO-MAGNETIC SWITCHES OPERATED BY ALTERNATING CURRENT, Igranic Electric Company, Ltd., of 147, Queen Victoria-street, London, E.C. 4, and Johann Hermann Abbink Spaink, of 25, Conduit-road, Bedford.

The alternating current clapper switch described in this specification is arranged so that only part of the winding is utilised for closing the switch, and subsequently the whole of the winding is brought into use for holding the switch closed. Thus when the switch is being closed, the reactance of the winding is reduced. As shown in the drawing, the winding is tapped at the point A. One end of the winding is connected to one

N°272,012



terminal B, and the other to the terminal C, through the auxiliary contacts D, which are normally open, but which close when the switch armature moves to the attracted position. The tapping point A is connected to the terminal C through the auxiliary contacts E, which are normally closed, but which open when the armature moves to the attracted position. When the current is supplied to the switch terminals, the contacts E are closed, and only that part of the winding is energised that is between the terminal B and the tapping point A. Subsequently, however, the contacts D close, and the whole of the winding is therefore energised. The main contacts are shown at F.—*June 9th*, 1927.

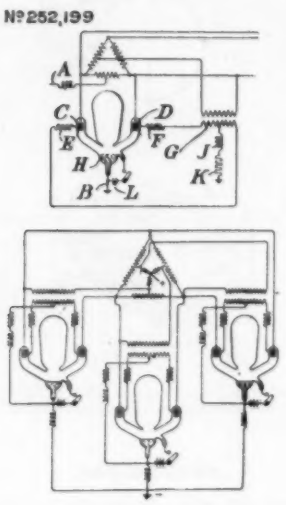
ELECTRICAL APPLIANCES.

252,199. May 17th, 1926.—IMPROVEMENTS IN ELECTRIC CURRENT CONVERTING SYSTEMS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.*

An improved arrangement is described in this specification for the interchange of power between direct and alternating-current power systems, involving the use of an electron discharge device. The main connections are self-explanatory, from the upper diagram, in which it will be seen that the anodes of a mercury vapour rectifier are connected to one phase of a three-phase

transformer, whilst the direct current is taken from the points A B. Grids C and D are connected to the three-phase system, through current-limiting resistors E and F, and a transformer G, the cathode H being connected through a resistor K and a reactor J to the secondary of this transformer. For igniting the rectifier, a battery L is provided. The reactor A smooths out fluctuations in the direct-current circuit, whilst the resistors E, F and K limit the current transmitted through the grids or control circuits, and the reactor J modifies the wave form of the grid potential. In order to impress a voltage on the grids that

№ 252,199



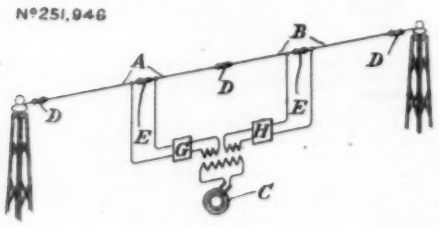
leads with respect to that impressed upon the corresponding anodes, the primary circuit of the transformer G is connected in the manner shown. It is essential that the transmission of current through one arm of the device should be initiated before its transmission through the other arm is terminated, and this is produced by the transformer arrangement G, which causes the grids to be charged to a positive potential slightly in advance of the working anodes C and D. The interchange of current between the direct-current system and all phases of the polyphase system may be effected by the use of three rectifiers connected as shown in the lower illustration.—*June 9th*, 1927.

TELEGRAPHS AND TELEPHONES.

251,946. February 25th, 1926.—IMPROVEMENTS IN RADIATING ANTENNA SYSTEMS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

Various methods are described in this specification of increasing the directivity of antenna systems radiating horizontally polarised waves, and one of the schemes described is shown in the accompanying drawing, where there are two radiators A and B fed in the manner shown from a source C. The radiators are spaced between centres of about half a wave length and each radiator is mounted between insulators D which are also spaced about half a wave length apart. The height of the radiators above the earth is approximately a quarter of a wave length The lines that connect the source of supply to the radiators are

№ 251,946



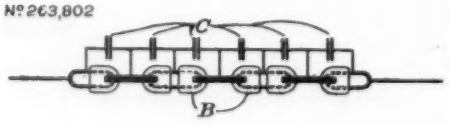
connected to adjacent points at approximately the centre of the radiators and these points are insulated from one another by the insulators E. Phase shifting devices G H control the phase relation between the currents in the two radiators, and by varying the phase relation of the currents in the radiators A and B the direction of the radiation may be controlled. If the currents in the two radiators flow simultaneously in the same direction the combined radiation will be at a maximum upwards and at right angles to the direction of the radiators, whilst if the currents in the radiators are of opposite phase the radiation will be at a maximum in a direction 45 deg. upwards in the length direction of the radiators. There are eight other illustrations.—*May 25th*, 1927.

TRANSMISSION OF POWER.

263,802. December 21st, 1926.—IMPROVEMENTS IN OR RELATING TO SUSPENSION OR CHAIN INSULATORS, C. Lorenz Aktiengesellschaft, of Lorenzweg, Berlin-Tempelhof, Germany.

In accordance with this invention, auxiliary capacities C are connected in parallel with the units of a chain insulator, in order to increase their relative capacities, and these auxiliary capacities

№ 263,802



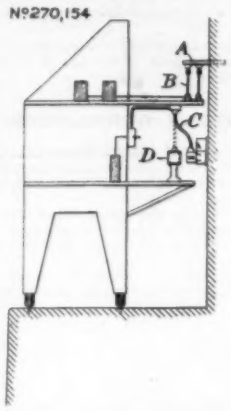
may be embodied in the construction of the insulating chain. The object of the invention is to obtain an almost even voltage distribution along the chain. In suspension chains composed of porcelain units B, the voltage applied at the ends of the chains is distributed in very unequal amounts across the individual insulators, and the function of the condensers C is to give a more equal distribution of the pressure.—*June 9th*, 1927.

CRANES AND CONVEYORS.

270,154. October 2nd, 1924.—PNEUMATIC GRAIN DISCHARGING PLANT, H. Simon, Ltd., and H. Williams, 20, Mount-street, Manchester.

The object of this invention is to reduce the amount of flexible cable necessary for supplying electricity to the motors of portable grain elevating plant. There are two trolley wires A and collectors B, which supply current for lighting purposes,

№ 270,154



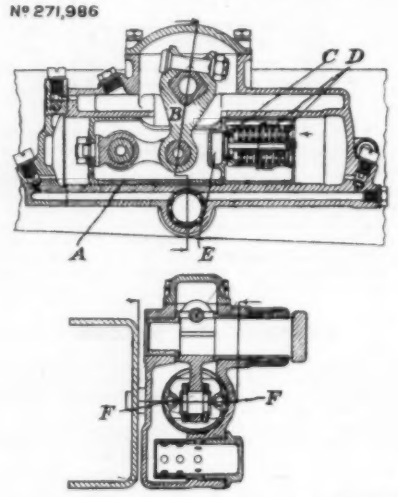
so that the light is always available. The heavier current for the motors is supplied by flexible leads C and plugs from boxes on the wall. Dummy boxes D are arranged on the gantry and when the plugs are withdrawn from the wall boxes they are put in the dummy boxes, where they operate an interlocking gear, which prevents the supply of current from the trolley wires to the motors.—*May 5th*, 1927.

MOTOR CARS AND ROAD TRAFFIC.

271,986. March 31st, 1926.—HYDRAULIC SHOCK ABSORBERS, F. H. Royce, Nightingale-road, Derby.

The object of this invention is to minimise the effect of variations in the viscosity of the oil used in shock absorbers of the dash-pot type. There is a hollow piston A, working within a cylinder, and connected with the crank B. In one end of the piston there is a mushroom valve C and a piston valve D, each controlled by a separate spring. These valves control a passage E which communicates with the other end of the cylinder by

№ 271,986



ports F F. When the piston moves to the right, oil is forced through the valve C to the left. If the piston moves to the left the oil goes to the right through the valve D. It is claimed that with apparatus as described apart from the valves, the liquid can pass freely from one compression chamber to the other and variation of viscosity due to change in temperature is negligible. The cross-sectional areas of each of the valves, and the consequential allowed range of opening are such that the valve opening accommodates itself to any such variations of viscosity of the liquid—*June 9th*, 1927.

271,718. October 21st, 1926.—IMPROVEMENTS IN POWER TRANSMISSION MECHANISM FOR MOTOR VEHICLES, Thomas Blackwood Murray, D.Sc., M. Inst. C.E.; and Albion Motor Car Company, Ltd., both of South-street, Scotstoun, Renfrew, Scotland.

The improved transmission gear described in this specification

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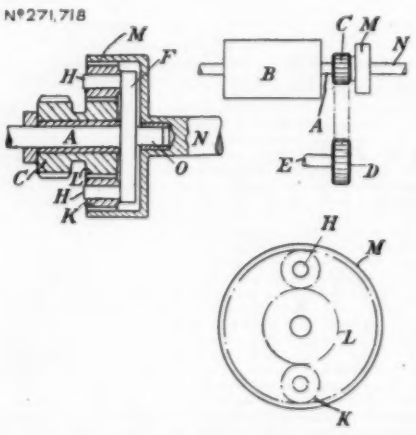


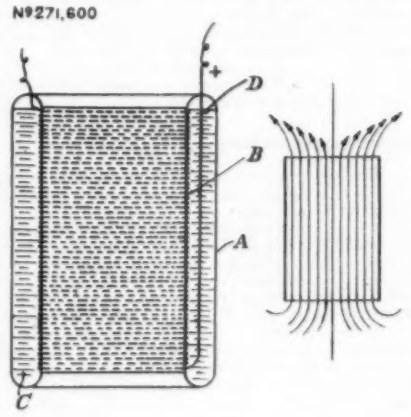
is intended for six-wheeled motor vehicles in which the front and twin rear axles are driven. The main shaft A of the gear-box B carries a chain wheel C which is loose on the shaft, and it is connected with another chain wheel D mounted on another shaft E which transmits rotation to the front axle. Fixed on the shaft A behind the chain wheel C is the disc or crosshead F carrying studs H with planet wheels K, which mesh with the sun wheel L and with the internally toothed wheel M. The sun wheel L may be in one piece with the chain wheel C or may be fixed to the wheel C, and is free on the shaft A. The internally toothed wheel M is fixed to or is integral with the tail shaft N leading to the rear axles. For steadying purposes a spigot bearing O is preferably introduced between the shafts A and N. If the relative pitch diameters of the wheels K, L, and M be 2, 4, and 8 the torque transmitted by the shaft A will be distributed in the proportion of one-third transmitted to the front axle and two-thirds to the rear axles, and for distribution of the torque in other proportions the diameters of the wheels K, L, and M may be suitably varied.—*June 2nd*, 1927.

LIGHTING AND HEATING.

271,600. March 22nd, 1926.—IMPROVEMENTS IN ELECTRICAL RESISTANCE HEATERS FOR LOW TEMPERATURES, John Gustaf Adolf Rhodin, of 16, Emerson-road, Ilford, Essex; and Ernst B. Westman, Ltd., of 39, Lombard-street, London.

According to this invention heat is generated in a metallic conductor of the lowest specific resistance obtainable and by an intense electric current. The heating arrangement illustrated consists of a double-walled copper cylinder A with a winding B in the annular space between the two component cylinders. The

№ 271,600



space C is filled up to the level D with molten paraffin wax or heavy oil and is hermetically sealed. The outside of the cylinder A is thermally insulated. The heater can be used in the vicinity of explosive mixtures without danger. If the heater is used under more ordinary circumstances the winding may be put on the outside of the metal tubes and the insulation may be applied directly to the winding. When in operation, the inner surface of the heater gets hot, and with the heater standing upright in a room eddies are formed as shown in the right-hand illustration. Heaters constructed on these lines may also be used for cooking and other purposes.—*June 2nd*, 1927.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—The works of the London Brick Company and Forders, Ltd. South Midland District meeting. 11 a.m.

SATURDAY, JULY 9TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South Wales District meeting: visit to Glamorgan Intervalley Roads. Meet at Treorchy Station 10.45 a.m. Paper by Mr. Geo. A. Phillips, M. Inst. C.E., County Surveyor, Glamorgan.

SATURDAY, JULY 16TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Council Chamber, Guildhall, Cambridge. Eastern District meeting. 2 p.m.

DOUBLE DRY GRINDER.—Our attention has been called to a slip of the pen in the description of a double dry grinder made by B. R. Rowland and Co., Ltd., of Reddish, which appeared in our issue of June 17th. The bursting speed of a wheel is given as 9400 r.p.m., it should obviously be feet per min. peripheral speed.

CENTENARY OF THE FIRST RAILWAY IN FRANCE.—We are asked particularly to remind our readers that the illustration showing the Lyons-St. Etienne Railway, which appeared upon page 680 of our issue of June 24th, is strictly copyright, and may not be reproduced without the permission of the owner of the original. In line 37, column 1, of the same page Rue de Gier should read Rive de Gier.

WORLD'S OLDEST REFRIGERATION SOCIETY.—In view of the important part that refrigeration is playing in the life of the nation to-day, it is interesting to hear that to this country belongs the distinction of having first established a national society of refrigerating interests, viz., the British Cold Storage and Ice Association, which was founded in 1900. This institution, after over a quarter of a century of existence, has at its annual meeting this month changed its name to "The British Association of Refrigeration," as its representation of the great industry of mechanical refrigeration and all its many applications has long extended beyond the cold stores and ice interests indicated in the old title. To the refrigerating industry of Great Britain belongs the great task of securing the fresh condition and the purity of a large proportion of the perishable food supplies of the nation, which, before the institution of the amended Food Regulations, were often treated with chemical preservatives.